

CHOOSING THE RIGHT TV & FM ANTENNAS

RADIO & TV NEWS

World's Leading Electronics Magazine

SEPTEMBER

1958

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REDUCING TAPE RECORDER NOISE AND HUM

THE "ELECTRO-MELODEON"

(A Musical Instrument)

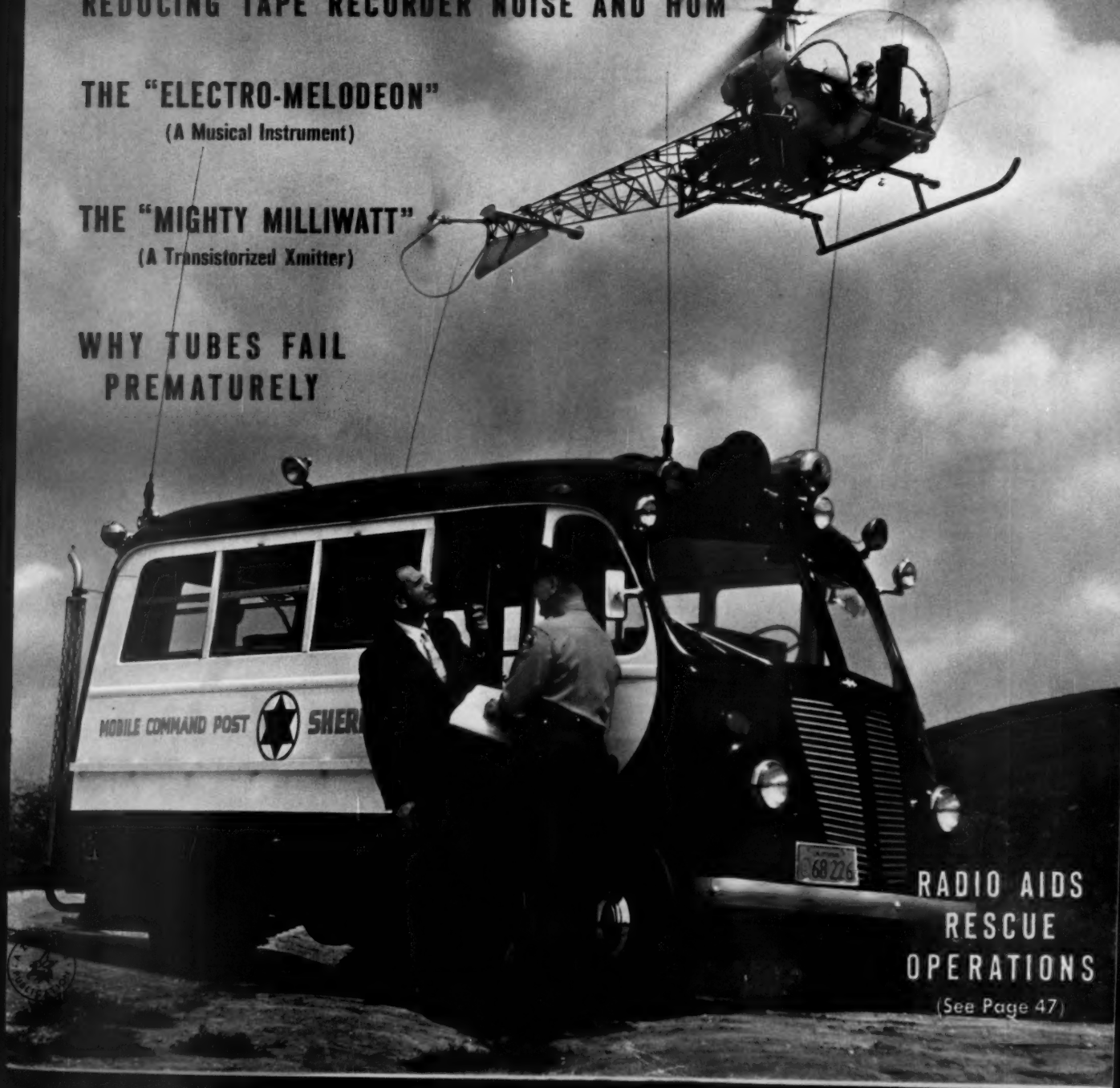
THE "MIGHTY MILLIWATT"

(A Transistorized Xmitter)

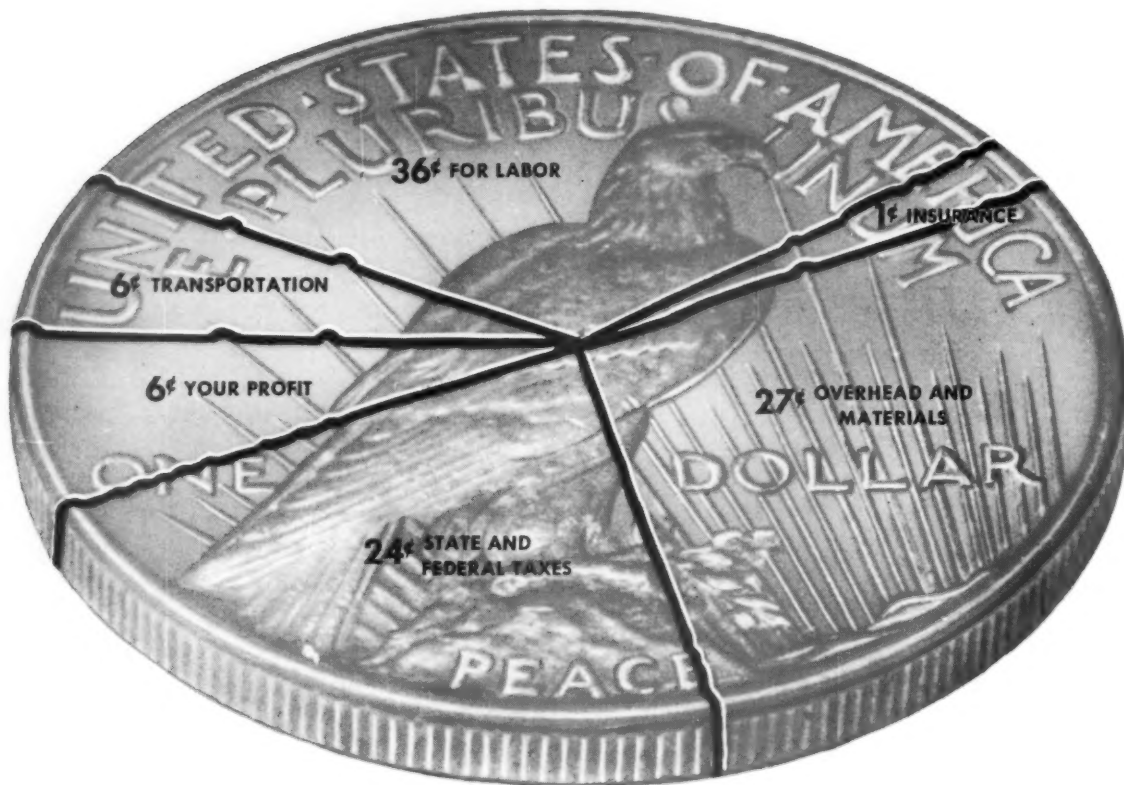
**WHY TUBES FAIL
PREMATURELY**

**RADIO AIDS
RESCUE
OPERATIONS**

(See Page 47)

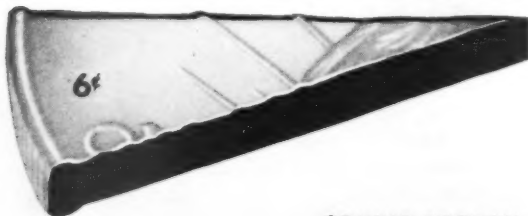


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Let your customers know how much they get and how little you make on an average service call. Show them this chart. It was compiled by an independent organization for Raytheon and is based on research of Independent TV-Radio Service Dealer costs from coast to coast. It might be a good idea if you studied it carefully to see if any phase of your business is costing more than it should.

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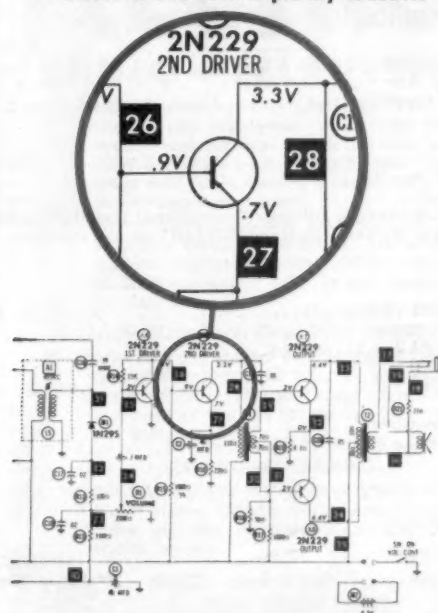


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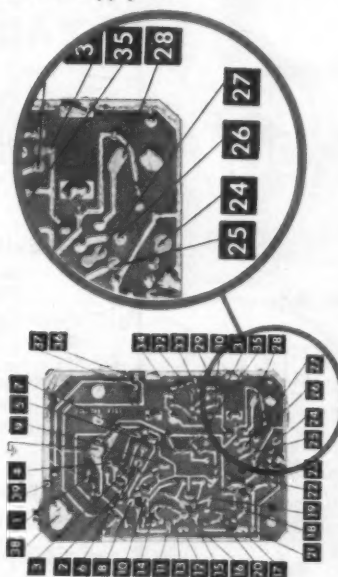
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September, 1958

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Sylvania comparisons point out—

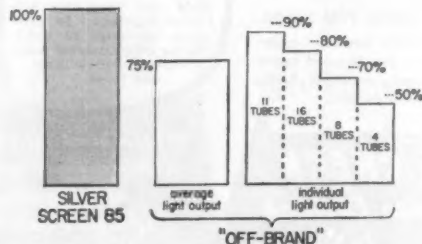
The big difference in Picture Tubes!

**Here's the inside story on why
local "off-brands" don't measure up
to Silver Screen 85® standards**

If you're like most dealers, you know off-brand tubes don't have the same quality standards as first-line tubes. To help you see how big the difference is, Sylvania purchased a nationwide sample of sixty 21YP4A's made by 19 different local tube makers. These tubes were put through the same production tests that all Sylvania tubes must pass.

Not a single local off-brand passed all 54 mechanical and electrical tests! Many of these were minor defects making little or no difference in whether or not the tube "lit up." But look how loose manufacturing controls can affect the important features of light output, focus, and life!

LIGHT OUTPUT



So far, 39 off-brand tubes have been compared with the *minimum* light output of Silver Screen 85. Five additional tubes couldn't even be tested. Eleven tubes were less than 90% as bright as the minimum for Silver Screen 85; 16 were less than 80%; 8 were less than 70%; and 4 were less than 50% as bright. Since most Silver Screen 85 tubes average as much as 125% of minimum standards, the difference becomes even greater. Small wonder that Silver Screen 85 is the easy way to more satisfied customers.

FOCUS

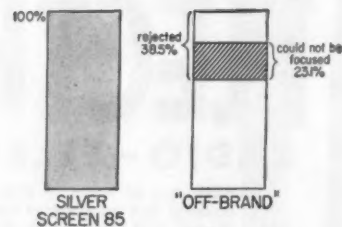
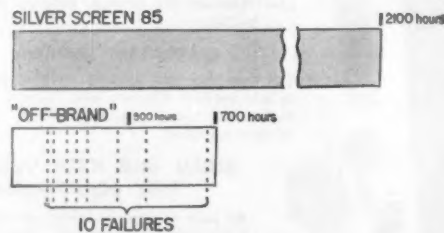


Chart 2 shows how these same 39 tubes stacked up to registered limits on focus voltage. 38.5% were rejected under these limits. Over half of all those rejected could not be focused in a TV receiver. Small wonder then that "Silver Screen 85" pictures are sharper, brighter, clearer.

LIFE TEST



Nineteen off-brand tubes were placed on Sylvania's standard 2000-hour life test. Chart 3 tells you how fast these tubes developed slow-heating cathodes. Over half, or ten units, failed to go beyond the 700-hour mark. Small wonder then that Silver Screen 85 gives you less troublesome callbacks.

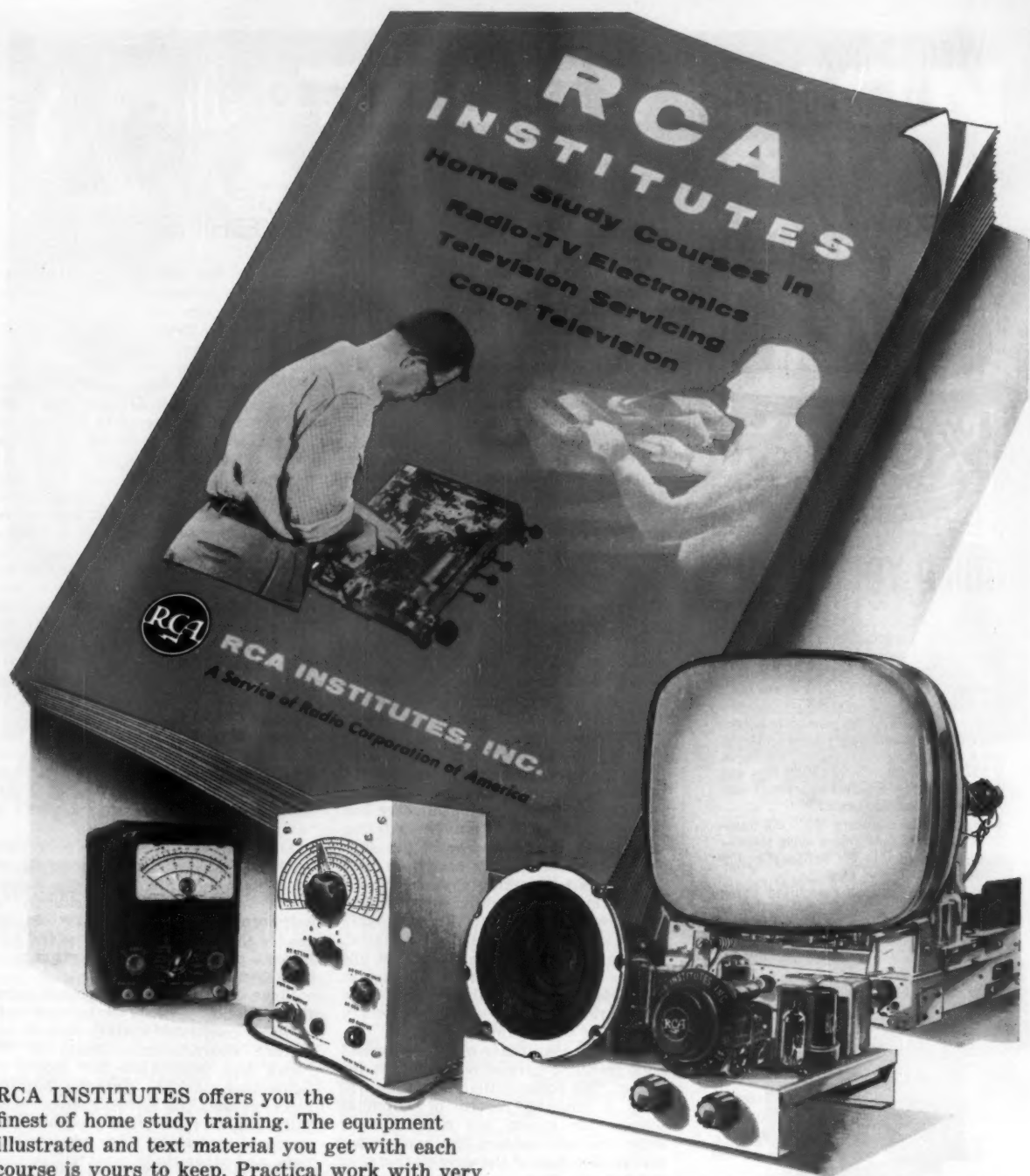
Of all the off-brand tubes tested, Sylvania engineers estimate that 43% probably would not have operated properly in a TV set. Why gamble your reputation, customer satisfaction, and success. It's just *good business* to sell up to "first line" picture tubes; Silver Screen 85 picture tubes.



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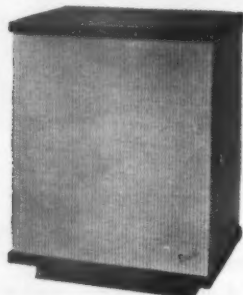
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...for the Record

By W. STOCKLIN
Editor



NO TIME FOR MAKESHIFTS

THIS month and next are generally conceded to be *THE* hurricane and tornado "season" despite the fact that some areas of the United States have already received tragic and costly visits from the high winds.

In what way does this phenomenon of nature affect those of us in the radio-TV industry? It all boils down to a matter of *responsibility*—responsibility to our customers who depend on us for professional and workmanlike installations and continuing maintenance. Although this industry responsibility extends to all the jobs we tackle, during this season of high winds we are especially vulnerable in the area of antenna installations.

If every antenna hoisted to a rooftop and every tower anchored in the ground is thought of as a *potentially* dangerous missile should it be uprooted from its location, the service company, the professional tower maintenance crew, or even the daring "install-it-yourselfer" will help to avert the many freak and often deadly accidents that occur during a big blow.

This is no time and no place for makeshifts! The antenna industry has done a magnificent job of building strong and sturdy antennas and supplying the specialized hardware and accessories for making a weatherproof installation. The installer who deliberately bypasses the readily available and relatively inexpensive installation aids in favor of improvised lash-ups carries a heavy load on his conscience. A workmanlike installation is a safe installation and no cause for worry should the winds start to howl.

Like any man-made object, antennas once installed cannot be forgotten for years. The conscientious installer will keep a running record of antennas whose "life spans" are nearing their ends. He will contact the homeowner and remind him of the devastation that has been wrought on his antenna over the years that it has been buffeted by wind and weather. Although many householders will choose to ignore the technician's recommendations on the theory that "as long as it works, it's OK," the responsible property owner will agree to a thorough inspection of his installation and authorize a replacement when required.

Depending on the part of the country in which you do business, such inspections should be made at from three- to five-year intervals. The "tornado belt" requires frequent inspections because of the danger of invisible damage and critical loosening of braces, guys, and anchors; the arid

sections of the country call for periodic check-ups because of the damage done by the sun and low humidity to the roofing materials to which the antenna is attached; coastal areas, vulnerable as they are to both hurricanes and deterioration from the high saline content in the air, demand thorough antenna testing every two to three years. Antennas installed in large metropolitan areas fight the dual battles of high winds and corrosion from industrial wastes. Because of these antenna hazards and because of the high congestion rate, it is vitally important that such antennas be checked on a regular and carefully scheduled basis. Antennas or antenna accessories hurled ten or more stories to the street are literally man-killers. There have been just enough reported cases of such occurrences to indicate that such fatal and near-fatal accidents are an ever-present hazard to the city pedestrian.

Now that the period of the "big winds" is upon us, it might be a good time to thumb through your records of antenna installations and give the homeowner a ring if his antenna is "living on borrowed time."

Although we have dealt only with the hazards of defective antenna installations thus far, there is a second factor which must be considered. A deteriorated TV antenna system degrades the picture and lessens the customer's enjoyment of any program on his television set.

Since we feel so strongly that something should be done to correct both of these conditions (safety hazard and picture degradation), RADIO & TV News has designated the month of September as "TV Antenna Month." In order that the homeowner be made fully aware of this vital program, promotional materials, store window banners, and other tie-in copy will be used as a continuing reminder to have his antenna system checked for safety and improved performance during "TV Antenna Month."

WPIX-TV Joins Campaign

We learned just prior to going to press that TV station WPIX, Channel 11, New York City, is also promoting the theme "Better Viewing." They, too, are cognizant of the fact that many antenna systems are outmoded and deteriorated by weather conditions. As a result they plan to run 25 spot announcements per week starting on July 21 and will continue to run them for a period of four weeks.

—50—

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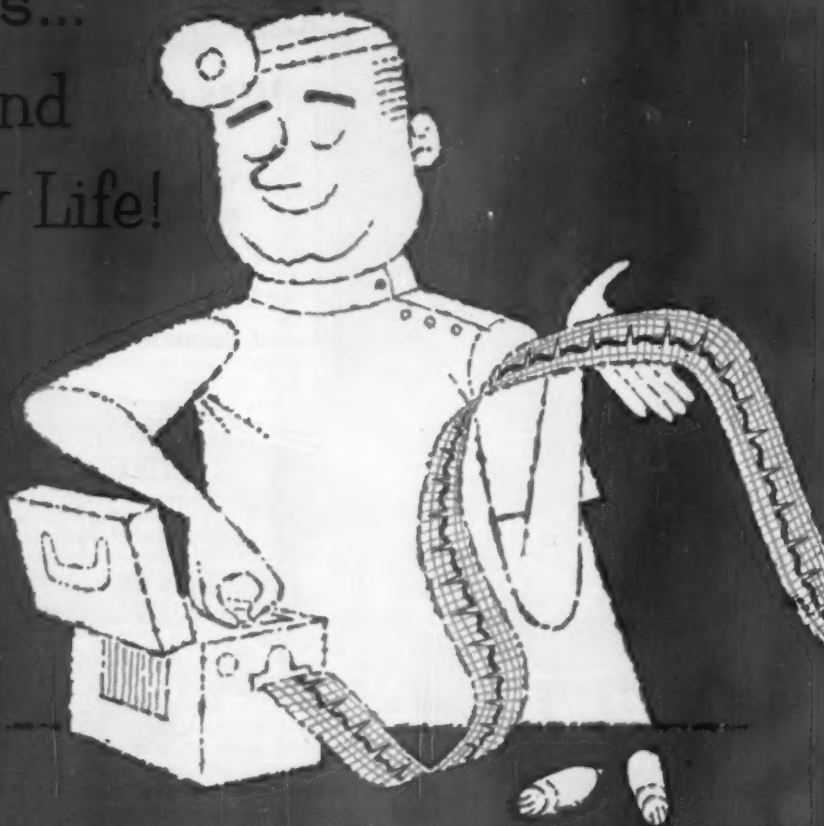
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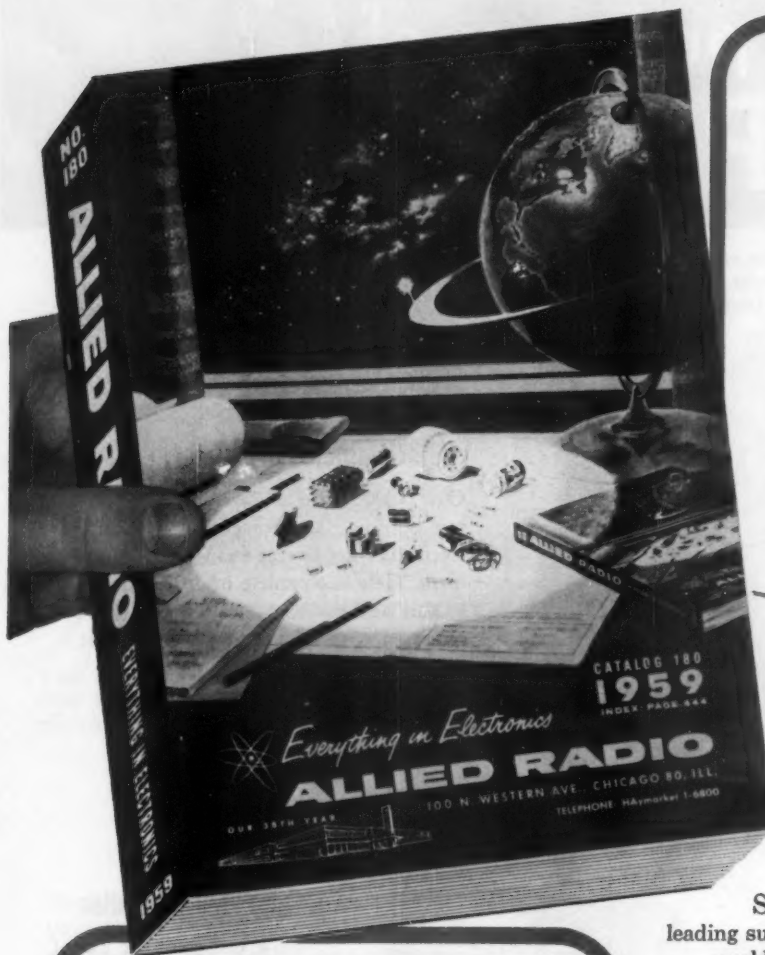
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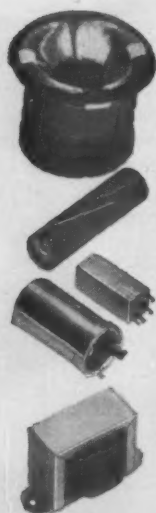


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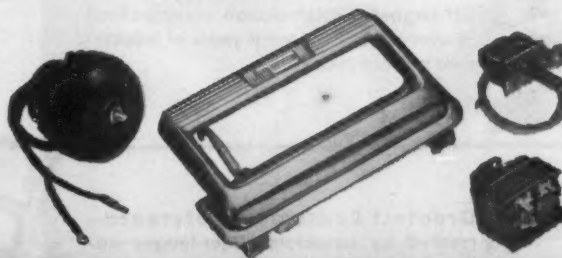
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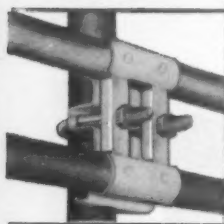
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There are more *CHANNEL MASTER T-W's*
on America's rooftops than any other
fringe-area antenna

Here's why the T-W is the
most popular fringe-area antenna



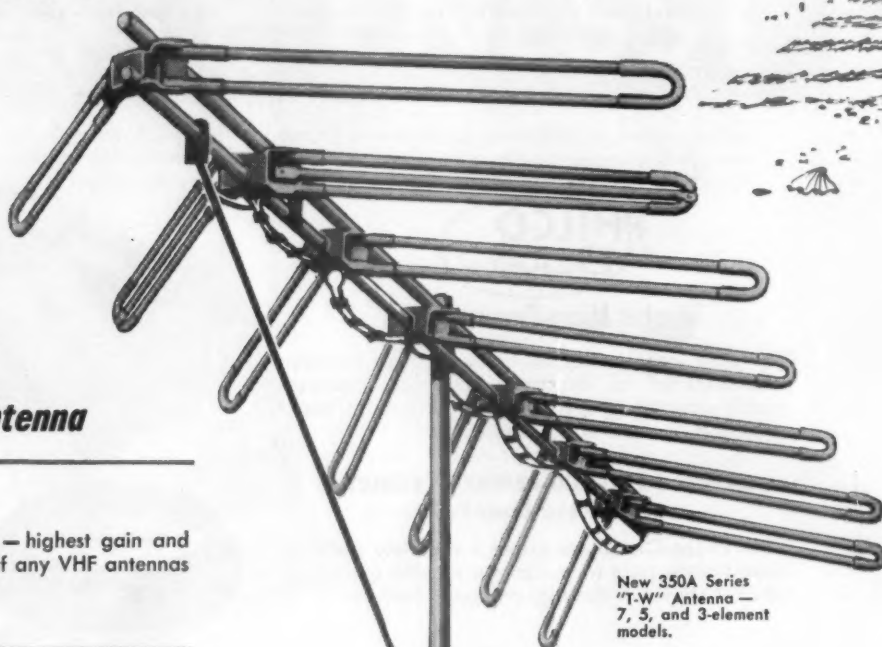
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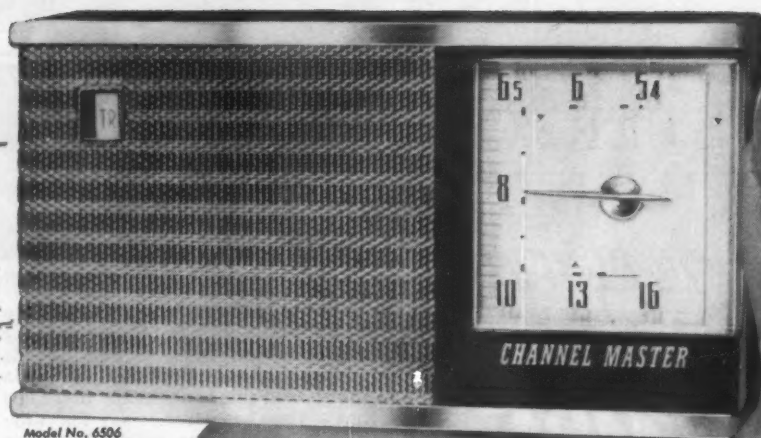
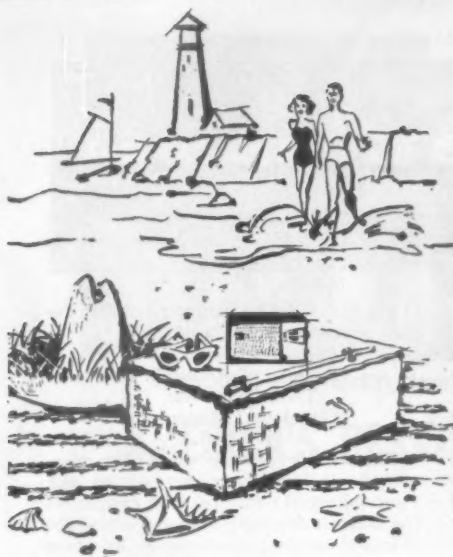
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New 350A Series
"T-W" Antenna —
7, 5, and 3-element
models.



Now, more than ever,
CHANNEL



Model No. 6506
6 transistors,
1 thermistor, 1 diode
5 3/4" long, 3" high,
1 1/2" deep

and now...

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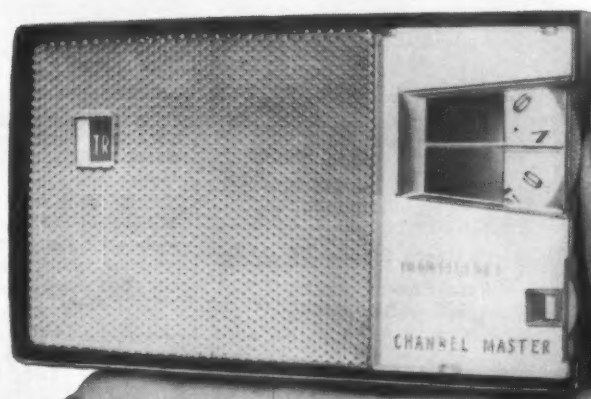
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6 transistors, 1 diode
4 1/2" long, 2 3/4" high, 1 1/4" deep

the big news is coming from

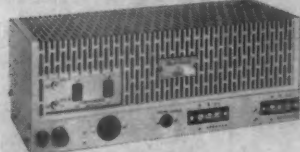
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Has power tap-off for SP-210
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Letters

from our Readers

"THE WEAKEST LINK"

To the Editors:

I greatly appreciated Herman Burstein's article "The Weakest Link" in the April issue of your magazine. It served to bolster my own private opinion and I, for one, agree with the article completely.

I am an ardent reader of audio articles and this is about the first time that anyone has dared to say that anything but the home playback system was at fault if reproduction was anything but perfect.

NORMAN GIUST
Canton, Ohio

To the Editors:

"The Weakest Link" article certainly hits the nail right square on the head. Good apparatus makes ordinary music sound better, but it makes better music from better program sources sound superlative.

WILLIAM A. SHERBORNE
Los Angeles, California

Author Burstein pointed out that "the weakest link" in the hi-fi system is not necessarily the transducer. He suggested a look outside the playback equipment.—Editor.

LICENSING EDITORIAL

To the Editors:

Congratulations on a most informative editorial on licensing (June issue). It was most refreshing to read an objective report free from hysteria on the pros and cons of a subject of great concern to the service industry. It is an issue that most people cannot be lukewarm about. You are either "fer" or "agin" it.

Since your editorial is so timely for us here on Long Island, we would like permission to feature it in our next issue of the "Guild News." Keep up the good work.

MURRAY BARLOWE
Editor, Guild News
Radio & Television Guild of
Long Island, Inc.
Bethpage, Long Island

To the Editors:

We are writing to ask for your assistance in obtaining copies of the licensing laws referred to in the June editorial on "Does Licensing Work?" Our local city council has agreed to act, if our Society can present a workable licensing plan to them. The experience of established groups will unquestionably save us a lot of time and headaches in developing an acceptable plan.

RADIO & TV NEWS has been a valued publication to the trade in this area for

years and is to be commended for the high standards maintained.

ROBERT R. YOUNG
Society of Radio & Television
Technicians Inc.
Glendale, California

Thanks for all the favorable comments we have been getting on our June editorial. For further details on the Detroit licensing law, you can probably get the best firsthand information from one of the associations most active in promoting the passage of this law, and which also had a hand in drawing it up. We suggest you write to Mr. Karl Heinzman, TSA of Michigan, 8225 Woodward, Detroit 2, Michigan.—Editors.

JUST TEN YEARS AGO

To the Editors:

I am attaching a couple of pages from your September, 1948 issue, which announced the transistor and the long-play phonograph record. It is interesting that your coverage of two such major developments happened to be in the same issue. The development of the long-play record was actually the basis of revitalizing the phonograph industry and certainly gave hi-fi equipment a boost. The effect of the transistor requires no elaboration, but it is certainly more extensive than most of us would have predicted ten years ago.

W. F. GEPHART
Dallas, Texas

It's sometimes hard to realize that these two major developments, which are so important today, are this young.—Editor.

BC-348 RECEIVER CONVERSION

To the Editors:

We have been recommended by Stromberg-Carlson Company to write you in regards to a military receiver, type BC-348P. We would like to have a schematic with voltages and other data listed. We understand you have published some of these schematics in the past, and we would appreciate receiving any information you have on the receiver.

HAIG G. HOSEPIAN
Sarkis Radio & Television Service
Mansfield, Massachusetts

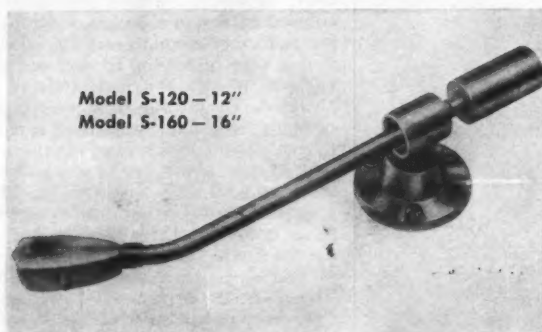
Although we did carry an article on the BC-348 for 10-meter operation in our February, 1949 issue, we are no longer able to supply copies of this material in any form. Perhaps your local library may be able to help you on this past issue. Your best current

RADIO & TV NEWS

REK-O-KUT TABLETALK

The latest high fidelity developments from Rek-O-Kut Co., Inc., 38-19 108th St., Corona 68, N. Y.

AMERICA'S BEST-SELLING ARM RE-DESIGNED FOR STEREO



Model S-120 - 12"
Model S-160 - 16"

PRICES OF THE NEW STEREO-MONAUROAL ARMS ARE: MODEL S-120, 12" ARM, \$27.95; MODEL S-160, 16" ARM, \$30.95.

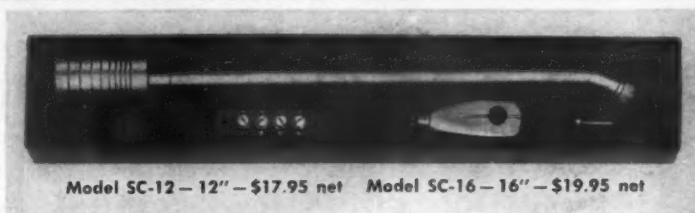
The fabulous Rek-O-Kut Tonearm (the arm that outsold all others 9 to 1) now goes stereo! Here are some of the new basic features which make this tonearm a "must" in any fine stereo or monaural high fidelity system: 1. Mass of the shell increased...to lower the point of resonance. 2. Larger, heavier counterweight. 3. 4-conductor lead...to accommodate all 3 and 4-terminal stereo cartridges. 4. Four-prong shell for easy phasing of stereo cartridges. 5. Supplied with wires already connected to terminal strip.

In addition, the new S-120 and S-160 Stereo-Monaural arms retain these exclusive engineering features of the famous A-120 and A-160 arms: friction-free micro-bearing pivot and adjustable Micrometer counterweight!

Stereo Conversion Kit Converts A-120, A-160 Monaural Tonearms For Stereo Reproduction!

Rek-O-Kut A-120 and A-160 Monaural Tonearms now can be easily and quickly converted for stereo with the new Rek-O-Kut Stereo Conversion Kit. The new kit saves Rek-O-Kut monaural tonearm owners a minimum of ten dollars, and includes all parts and two simple tools required for the conversion. The procedures are simple...the entire conversion can be made in ten minutes. No mechanical skill is needed, no tools, other than those furnished in the kit, are required.

The ease with which conversion can be made reflects the simplicity of the basic Rek-O-Kut Tonearm design. All parts are warranted.

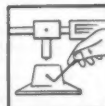


Model SC-12 - 12" - \$17.95 net Model SC-16 - 16" - \$19.95 net

Conversion Made In 3 Simple Steps

The arm assembly is removed from the base by loosening a single set screw with wrench provided. Old arm and counterweight are removed from swivel by loosening two screws. New pre-assembled stereo arm and counterweight are inserted in swivel and 4-conductor lead is pulled through the bottom.

After re-assembly, leads are connected to the terminal block furnished in the kit.



SPECIAL FREE OFFER!

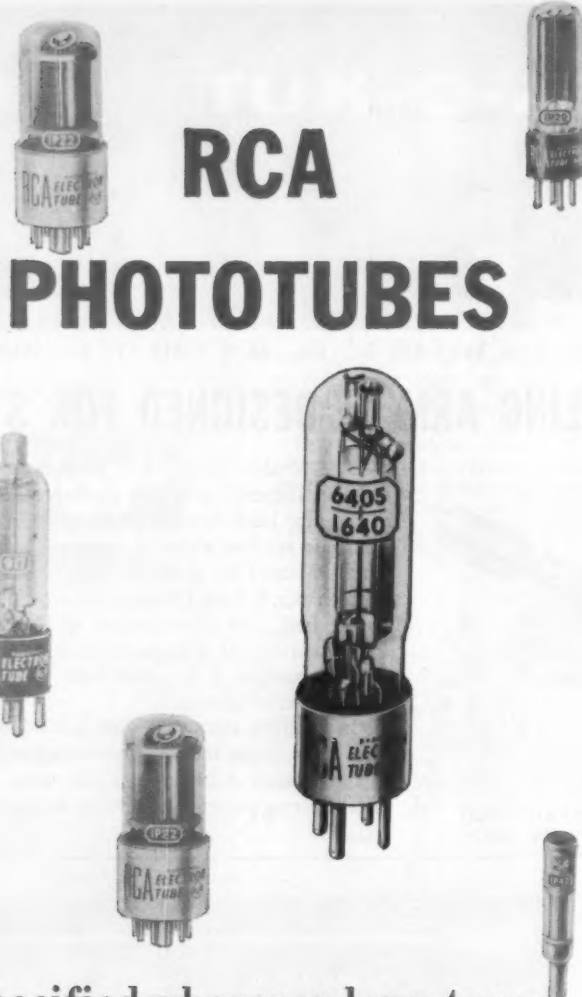
Popular Audax Stylus Balance
Your Gift With Purchase Of
Stereo Arm or Conversion Kit!

The free gift of a popular Audax Stylus Balance (regular value - \$3.95), is now being offered by Rek-O-Kut to purchasers of either the new Stereo-Monaural Tonearm or Conversion Kit. This special premium is automatically included with both of these new products now available from your high fidelity dealer. The Audax Stylus Balance gift offer ends August 31st, 1958.

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source for conversion data would be R. E. Goodheart, Box 1220, Beverly Hills, California. We suggest you write for a copy of the Goodheart catalogue since there are no less than six separate listings for this receiver.—Editors.

CABLE TRACER-CHECKER

To the Editors:

Eureka! You have done it. You have come up with another first. Refer to page 42 of your May issue. Mr. Frantz has convinced you that he uses a 1.5-volt battery, connects it to a cable, and gets himself a 4-volt reading on his meter. Why go on wasting money on tubes and transistors when just a little piece of wire will do the trick?

The equipment no doubt has its uses. However, in this day of multi-colored cables, the problem should not normally be encountered. More often it is a case of having to sort out pairs such as blacks and reds twisted and shielded. By far the most useful piece of equipment then consists of a pair of power phones and a man on the other end of the cable. Of course, it will work as well with single wires. Using a ground or any other convenient wire as a common, the man on one end marks a wire, connects the other side of his phone to it and starts talking. The man on the far end searches him out, receives his instructions as to how the wire is to be marked, and then the first man moves on to another wire. Forty or fifty wires can thus be sorted out in a matter of minutes.

Your magazine still rates tops with me.

G. A. JONES
Mt. Dora, Florida

We must admit when we first proof-read these pages, we came to the same conclusion that Reader Jones did, but if the article is reread very closely, it will be found that Mr. Frantz does not get something for nothing.

He is simply reading the voltage from a 1½-volt battery on a dial scale that is greater than the battery voltage, and he is using the numbers on this scale arbitrarily because they are more convenient. Please note that the meter is actually set to the 1½-volt range, but that readings are taken on a higher scale.—Editors.

ELECTRONIC IGNITION ANALYZER

To the Editors:

With reference to the article "Electronic Ignition Analyzer" (July issue), kindly advise as to the correct value of the component shown as R_{12} . This component is shown as a fixed resistor in the diagram (Fig. 7), but is referred to in the parts list as a 5-megohm potentiometer. Which is correct?

RICHARD C. HEINTZELMAN
Camp Hill, Pennsylvania

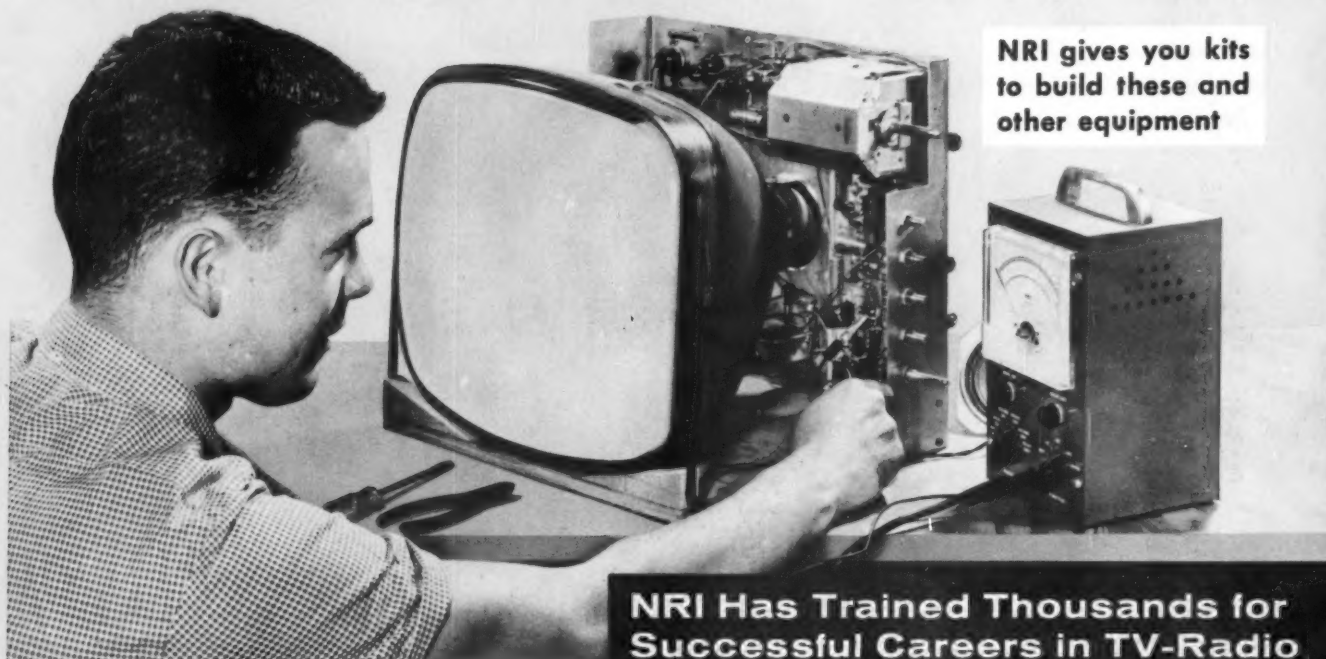
Actually, the diagram is right. R_{12} is a 5-megohm, ½-watt fixed resistor and should have been so shown in the parts list.—Editors.

—30—

RADIO & TV NEWS

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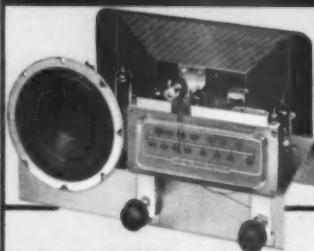
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Use it to earn extra cash fixing neighbors' sets; bring to life theory you learn from NRI's easy-to-understand texts.



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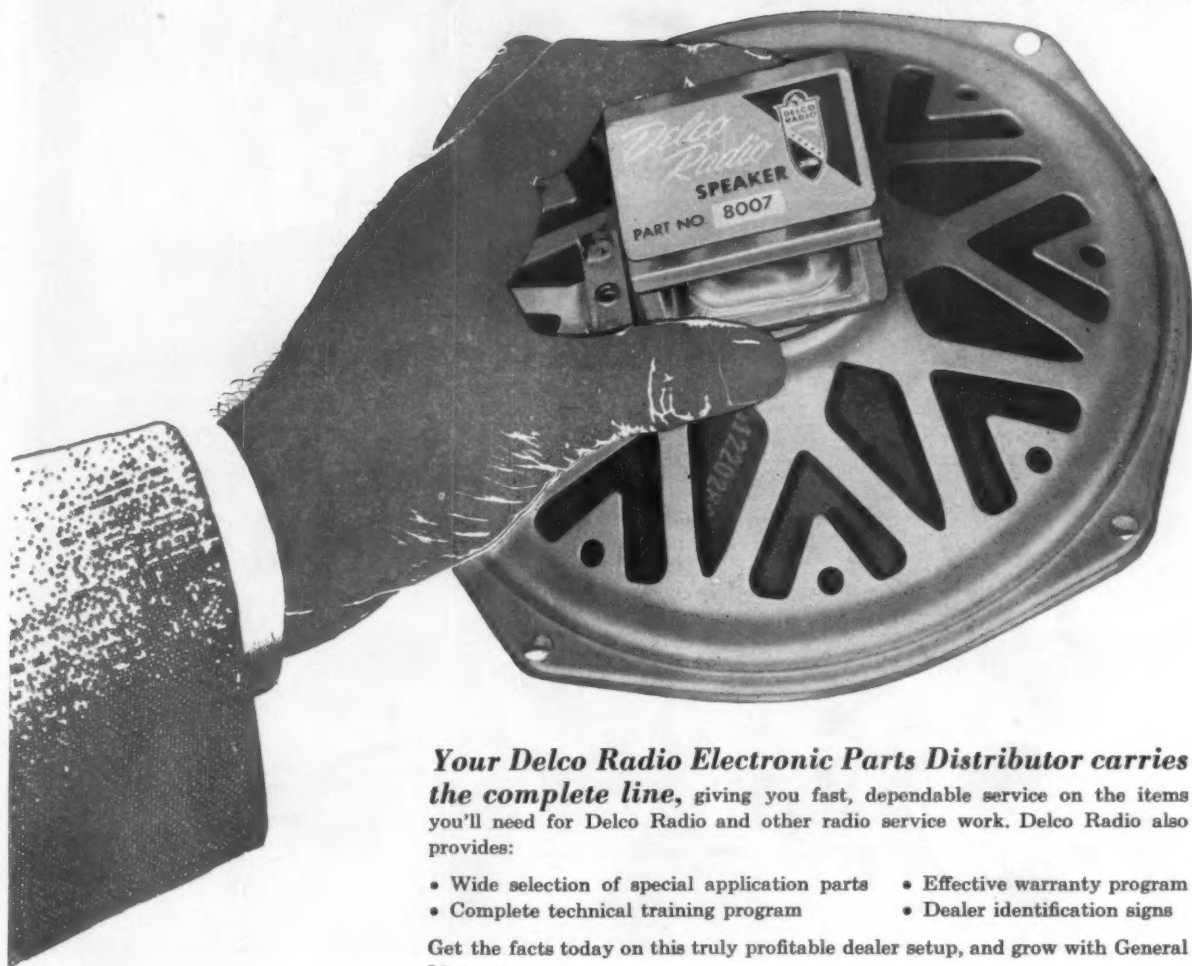
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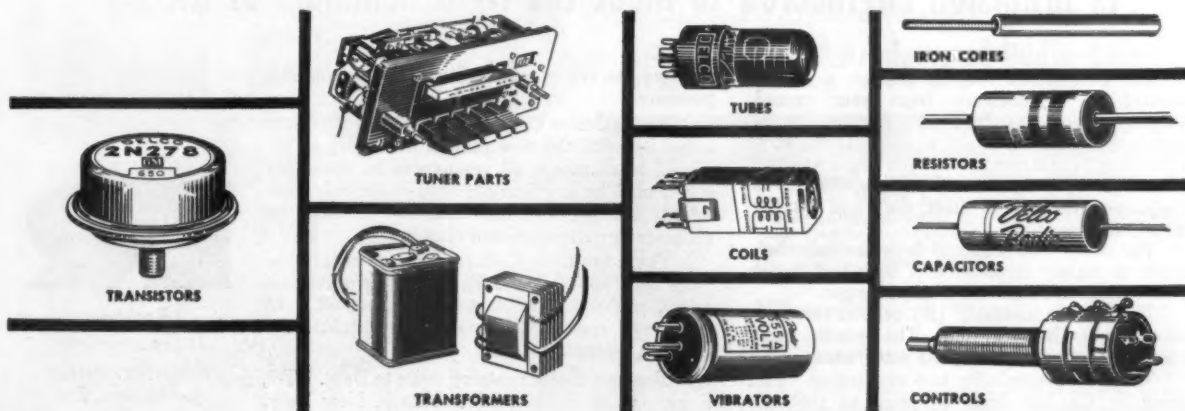
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There are three Collaro changers ranging in price from \$38.50 to \$49.50. No matter which you select, you're sure to start your system off right when you choose Collaro — the turntable that changes records.

For new Collaro catalog write to Dept. RT-9, Rockbar Corporation, Mamaroneck, New York.



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for Collaro, Ltd.

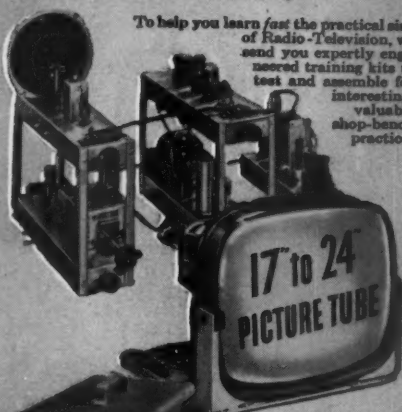
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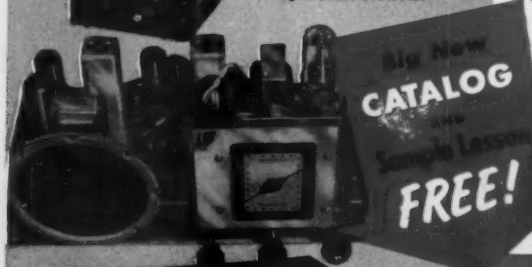
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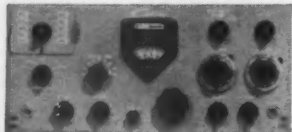
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Collins **KWM-1**



first SSB transceiver for complete
Mobile or Fixed use

The revolutionary KWM-1, the first mobile transceiver to offer SSB. And this 14-30 mc 175 watt package is equally adaptable to fixed use with simple removal from a convenient mounting tray under the dashboard.

Utilization of common components in both transmitting and receiving functions results in a saving of both space and cost and, in the case of frequency-determining components, assures exact coincidence of transmitted and received signals. Frequency stability and readability is comparable to that of the KWS-1/75A-4. The panel meter serves as an S-meter during receive and multimeter during transmit. Break-in CW using VOX circuits is built-in, as is a side tone for monitoring CW. Ten 100 Kc bands are available anywhere in the 14-30 mc range.

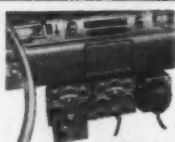
NET PRICES

KWM-1 Transceiver	\$820.00
516E-1 12 vdc Power Supply	262.00
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312B-2 Speaker Console with phone patch and directional wattmeter	205.00
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FOR 52 -OHM COAX

Here's a high quality device for continuous measurement of standing waves on transmission lines. Suitable for frequency range from 3 to 200 mc. See the article in QST June '57

Complete, with instructions
\$29.95

FEATURES: Uses sensitive 0-100 microamp meter • For continuous line insertion • Power to 1000 watts and over • Prevents false loading from antenna tuner, match box, PI network • SWR observed immediately at all times without adjustment •

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Within the Industry

VICE-ADMIRAL CHARLES B. MOMSEN, USN (Retired) has been elected to the

board of directors and named as consultant to *CREI* *Atomics, Inc.*, a division of the *Capitol Radio Engineering Institute*.

Admiral Momsen is a graduate of the U. S. Naval Academy, with a Bachelor of Science degree. He was actively identified with the submarine service throughout a naval career which kept him in uniform for 41 years. In 1926 he submitted to the Navy Department a design for a submarine rescue device which led to the much-heralded "Rescue Chamber." Together with several colleagues he invented the individual escape device now known as the "Momsen Lung." For this he was awarded the Distinguished Service Medal.

In addition to his affiliation with the Institute, Admiral Momsen is consultant to *General Dynamics Corp.*, *U. S. Rubber Company*, *Raytheon Manufacturing Company*, and the *Coleman Engineering Company*.



INSTITUTE OF HIGH FIDELITY MANUFACTURERS announces the election of the following firms to membership in the organization: *California Cabinet Company*, *Electrovox-Walco*, *Minnesota Mining and Manufacturing Co.*, *Reeves Equipment Corp.*, *Superscope, Inc.*, *United Speaker Systems*, and *V-M Corporation*. Also, radio station WRFM was elected to associate membership.

The Institute also announces the election of Milton D. Thalberg to its board of directors. Mr. Thalberg will continue as treasurer of the association and is president of the *Audiogersh Corporation* and *Kingdom Products*.

J. E. BROWN has been elected vice-president in charge of engineering by the board of directors of *Zenith Radio Corporation*. He assumes the post vacated by the death of Gilbert E. Gustafson.

Mr. Brown joined the corporation in 1937. He was made chief engineer in 1940 and has been assistant vice-president since 1943. From 1924 to 1936 he was a member of the radio division of the U. S. Department of Commerce, the Federal Radio Commission, and the Federal Communications Commission.



He is a member of the Institute of Radio Engineers and a former member of its board of directors. In addition, he is also a past president of the Radio Engineers Club of Chicago.

ELECTRONIC INDUSTRIES ASSOCIATION has named H. Leslie Hoffman chairman of the organization's Annual Awards Committee for the 1958-59 fiscal year. The committee's responsibility is to recommend to the board of directors the recipient of the 1958 EIA "Medal of Honor" in recognition of outstanding contributions to the electronics industry by an individual or firm—the association's highest award.

Mr. Hoffman is a director of the group and president of *Hoffman Electronics Corp.*

RICHARD H. CHAMBERLIN has been named manager of the newly created product design department of *Eitel-McCullough, Inc.*

Mr. Chamberlin joined the organization in 1943 as a machine designer and was later named mechanical engineer, head of design engineering department, administrative assistant to the manager of manufacturing, and manager of the receiving tube production department.

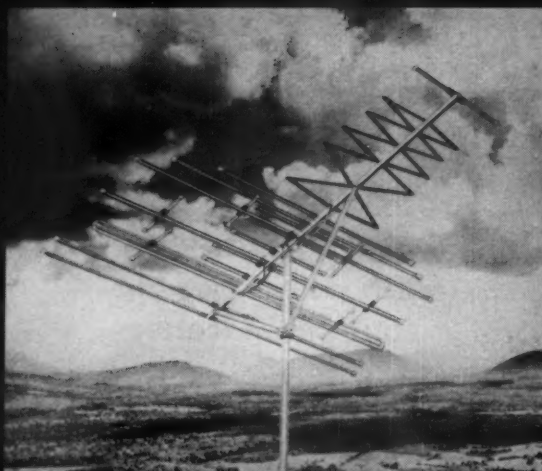
In his new position he is responsible for the design of negative grid and rectifier tubes and their components.



LITTON INDUSTRIES, INC. has completed preliminary negotiations for the purchase of **WESTREX CORPORATION**, a wholly owned subsidiary of **WESTERN ELECTRIC COMPANY**. The two organizations are working out the details of the transaction, such as a patent license agreement... **SHURE BROTHERS, INC.** has announced a decision to acquire an additional electronics manufacturing firm. According to S. N. Shure, president of the firm, interest is focused, although not limited, on component manufacturers engaged in high-fidelity sound reproduction and electronic industrial automation... The establishment of a new stereophonic producing and recording firm, **SONIC ARTS, INC.**, in association with the laboratories of **ROBERT OAKES JORDAN, INC.**, with offices at 333 N. Michigan Avenue, Chicago, Illinois, has been announced by Elliott M. Moore, president. The firm will specialize in development of business, industrial, and educational uses of stereophonic sound... Allen R. Dutcher and Eric Pohle have formed

How to take **DEAD AIM** on the **TV ANTENNA REPLACEMENT MARKET!**

IT'S OPEN SEASON on 10,000,000 obsolete fringe area TV antennas.
But it's going to take high-powered ammunition to nail tough antenna
replacement prospects.



MODEL **VXIII**

\$47.50 LIST



SATELLITE-HELIX TV ANTENNA

has the performance, the construction, the reputation that shatters buying resistance.
That's why servicemen and installers have sold more Satellite-Helix antennas during the
past three months than any other fringe antenna.

Here are the reasons why it hits the sales bullseye:



Advanced ENGINEERING! Balanced sleeve dipole design
plus 28 working elements *flattens* mountains, *shrinks* the
miles for superlative reception.

Powerful CONSTRUCTION! 15 inch aluminum dowel
reinforced elements, six 1/2 inch o.d. seamless elements,
double U-bolt assembly, double one inch tubular boom
brace, and unbreakable Kralastic B insulators.

National ADVERTISING! Impact ads in all media pre-
sell your antenna replacement markets.

Co-op PROMOTION! Supports service-dealers with the
most generous advertising allowance in antenna history
plus largest assortment of mats, TV and radio spots and
display helps.

Free INCENTIVES! With each 10 Satellite-Helix antennas
you get FREE a deluxe innerspring padded aluminum
chaise lounge (\$49.95 retail).

See your JFD Distributor now.

Go for "Big Game" Antenna Replacement Profits with the Satellite-Helix!

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Pioneers in electronics since 1929
JFD ELECTRONICS CORPORATION
BROOKLYN 4, NEW YORK

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FEDERAL ELECTRONIC PRODUCTS, INC., 1380 Pompton Avenue, Cedar Grove, N. J. The firm plans to manufacture gun mounts for television and industrial tubes such as radar, oscilloscope, storage, and pick-up tubes. In addition, qualified personnel and equipment are available for precision welding and small electronic parts assembly. The organization will also provide an engineering consultation service . . . The formation of **GENESYS CORPORATION**, a wholly owned subsidiary specializing in the field of electronics, has been announced by **CHANCE VOUGHT AIRCRAFT, INC.** . . . **MASSA LABORATORIES** of Boston, Mass. has become a division of **COMU ELECTRONICS, INC.** The new division will continue to operate in the Boston plant . . . The formation of the **TROLEX CORPORATION**, with production facilities and offices at 4322 Warren Avenue, Hillside, Ill., has been announced by Kenneth C. Allison, president. The electronics firm initially will manufacture a new type of wafer switch for use in television, radio, and laboratory instruments, among other products.

HOWARD HOLDEN has been appointed vice-president in charge of production at *Central Electronic Manufacturers, Inc.*, Denville, N. J.

Prior to his appointment as vice-president, Mr. Holden held the position of plant manager. Before joining the company in 1949, he held production management positions with the *Pasteuray Corporation* and with *Federal Telephone and Radio*.

Mr. Holden brings 26 years of experience in the management of electronic tube production to his new assignment.

DAVID R. HULL, vice-president of the defense programs of *Raytheon Manufacturing Co.*, has been elected president of the Electronic Industries Association.

Before joining the electronics firm in 1950, he was with *International Telephone and Telegraph Corp.* as vice-president, and director of the *Federal Telecommunication Laboratories*. He was also executive vice-president and director of *Capehart-Farnsworth Corp.*

A graduate of the U. S. Naval Academy, Captain Hull specialized in underwater sound and radar development prior to World War II. During the war he advanced to the position of assistant chief of the bureau for electronics, Navy Department; the senior Navy position in electronics materiel. For his pre-war work, Captain Hull received a Navy commendation ribbon and citation and for his service during the war he was awarded the Legion of Merit.

He also holds a Master of Science degree from Harvard University and has been awarded fellowships by the

(Continued on page 162)



How to Pass

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Get Your FCC License

We Guarantee
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Your FCC License

Completion of the Master Course (both Sections) will prepare you for a First Class Commercial FCC License with a radar endorsement. Completion of Section 1 only of the Master Course will prepare you for a Second Class Commercial FCC License. We guarantee to train and coach you, without any additional cost, until you receive the FCC License as indicated above. This guarantee is valid for the entire period of your enrollment agreement.

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in a Minimum of Time

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here's proof of good jobs

Irving Laing:

"Your lessons are helping me a lot in my Navy work. You cover topics that were not presented by the Navy at the E.T. School. . . . Your course has helped greatly to get my 2nd class FCC ticket. I am now a radio and T.V. engineer at WTVS and WDTR in Detroit, Michigan."

*Irving L. Laing,
15887 Robson,
Detroit 27, Michigan*

James Glen:

When Jim enrolled, he was a temporary employee of the City of Tacoma, Washington. In the space of 14 months, he completed the Master Course and received his first class license. He is now installing and maintaining mobile and microwave equipment.

*James S. Glen, Jr.,
2920 Knob Hill Road
Tacoma, Washington*



To Cleveland Institute

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American Airlines
American Telephone &
Telegraph Co.
Bendix Radio
Braniff Airways
Burroughs Corp.
Capital Airlines
Continental
Air Lines, Inc.
Convair
General Electric
Glenn L. Martin Co.

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**TV antenna sales are up substantially
for Finco jobbers and dealers!**

The secret is Finco's exclusive Models Unlimited program which enables you to offer *YOUR* customers antennas that are custom-engineered for your area . . . your terrain . . . your channels . . . your front-to-back ratio conditions . . . your gain requirements—yet they cost no more than ordinary types!

FINCO has already developed over 300 special antennas giving their jobbers and servicemen a big jump on competition for the red-hot replacement market. See your jobber today or contact The Finney Company.



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IN SOLVING UNUSUAL, LOCALIZED RECEPTION PROBLEMS, FINCO has proved that the only positive way to develop the most efficient and economical TV Antenna is by actual MOBILE RESEARCH LABORATORY TESTS combined with Expert Topology and Channel Power Plotting.

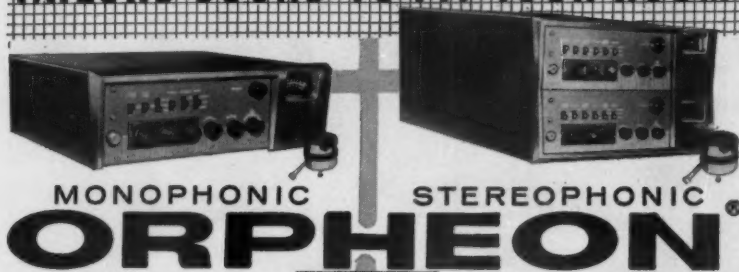
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NOW... FOR THE FIRST TIME... Ortho-Linearization TAILORS SOUND TO FIT YOUR ROOM



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Now, for the first time, you can actually tailor the performance of a superb amplifier to suit the acoustics of your room! AAS*—the Acoustical Analyzer System—Precise Development's exclusive new feature accomplishes this amazing feat. And AAS* is found only in the great, new ORPHEON amplifier. Using an Acoustical Analyzer Probe, you can actually adjust the low and high frequencies separately to match the mid-range tones, and provide perfect linearity to match the acoustics of your own living room! And once the adjustment is set, the ORPHEON remains in balance unless there are major changes of furniture or drapes in the room.

FEATURING AAS*

To match the musical tastes of everyone, Precise Development, Inc. provides two versions of the great new ORPHEON—one Monophonic, and the other Stereophonic. The MONOPHONIC ORPHEON offers 40 watts of undistorted listening pleasure plus every important feature you'd expect to find in a luxury-class amplifier. The STEREOPHONIC ORPHEON provides the greatest flexibility ever offered an audiophile. It comprises two systems in a single chassis—each one identical with the monophonic version described above. They may be used together to reproduce brilliant, clean, linear stereophonic sound, or may be used separately to serve two separate areas monophonically with different music... or they may be used together as an elaborate mixer for recording.

Before you buy stereo, be sure to hear this great new amplifier concept. It's a revelation of the ultimate in high fidelity engineering!

... Just Look At These Amazing Features ...

- 40 watts monophonic output (peak 80 watts)
- 80 watts stereo output (peak 160 watts)
- Inputs for radio, TV, tape, microphone and magnetic or crystal phono on each system segment
- Tape and monitor outputs on each system segment
- Calibrated Microphonic Acoustical Probe for AAS* can also be used as push address microphone or for tape recording
- 24 positions of equalization for each system segment
- DC on input filaments
- At least 18 db of bass and treble boost attenuation plus additional 20 db with AAS*
- Volume and Loudness controls on each system segment; 5 mv full output
- Rumble filter • Muting filter
- Output meter reads power output in watts or tape output in volts on each system segment. It is also a Sound-level Meter with AAS*
- Separate tape output level potentiometer on each system segment
- Cathode-follower tape output on each system segment
- Internal grid bias hum control (—80 db for radio, —50 db for phono)

Model AM40A—Monophonic, 40 watts (80 watt peak), with AAS*—factory-wired complete, \$189.50

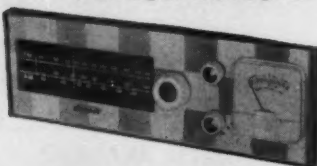
Model STAM80A—40 watt stereo system (160 watt peak, monophonic), with AAS*—factory-wired complete\$169.50

Model STAM40A—20-watt stereo system (80 watt peak monophonic), with AAS*—factory-wired, complete\$289.50

Model ST40—20-watt stereo system (80 watt peak, monaural), without AAS* and Acoustical Probe, factory-wired, complete.....\$249.50

*PATENT APPLIED FOR

THE Continental

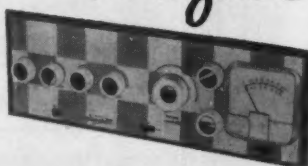


A superb AM and FM tuner providing matched performance and great beauty. Coupled with variable automatic frequency control and metered output, it brings in the weakest stations and provides razor-sharp selectivity. Rich gold-and-silver trim. Hear the Continental... discover how inexpensively you can own one of the finest tuners made today.

FM—88 to 108 MC; AM—500 to 1600 KC. Output tuning meter; cathode-follower output; convenience outlet; phono, FM, AM, TV switch and inputs; Foster-Seely discriminator; flywheel tuning; 2 limiters; Farri-loc; 3-gang variable condensers; logging scale, 13" x 4 1/4" x 9 3/4". Case at additional cost.

Model TUMK, Kit\$49.95
Model TUMW, Factory-wired\$59.95

THE Mozart



A superb 40-watt amplifier which supports a symphony orchestra with live, crisp, brilliant, distortion-free reproduction.

24 positions of equalization; DC on input tube filaments; Volume or Loudness Control; 5 mv full output; rumble filter; muting switch; convenience outlet; output meter reads power output in watts, tape output in volts; separate and independent tape output level potentiometer; cathode-follower tape output; internal grid bias, grid balance and hum balancing controls (—80 db for radio, —50 db for phono); output selector for different impedance speakers; A-B-B speaker selector; special potentiometer output transformer; silver-plated, etched-front panel; 10 tubes; fused supply, 13" x 4 1/4" x 12".

Model AMK, Kit\$49.95
Model AMW, Factory-wired\$89.95

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September, 1958

The Greatest In. TEST INSTRUMENTS

... that's the opinion of leading electronic engineers, radio service people and amateur radio enthusiasts. And Precise has achieved this reputation, too, because of its efforts to bring you the best possible equipment at the lowest possible prices. You can depend on Precise for quality—based upon ingenuity, originality, and production "know-how."

Mutual Conductance and Emission TUBE TESTER



Here is a tester that actually checks a tube for its application, not whether it is just good or bad. GM and emission are checked separately. It is the first and only device that measures 600-mil tubes on a meter. Sweeps from 0 through the normal testing range when making measurements to give an average evaluation of the tube over an extended range of operation. Selected for use by the United States Department of Standards.

MODEL 111K, Kit, \$79.95; MODEL 111W, Factory-wired\$139.95



Precise Development's POWER-LAB

A single instrument that takes the place of eleven pieces of equipment. Operates as A BATTERY ELIMINATOR, BATTERY CHARGER, HIGH CURRENT (20-AMP.) LINE VOLTAGE VARIAC, AC LINE VOLTAGE METER, AC LINE AMMETER, AC LINE WATTMETER, AC LINE ISOLATION TRANSFORMER, LOW-VOLTAGE HIGH-CURRENT AC SUPPLY, DC LINE VOLTAGE VARIABLE SUPPLY, DC HIGH CURRENT AMMETER, AGC BIAS BOX. Large, professional meter—it's fantastic—and what a value! With 100 watts of isolation. MODEL 711, Kit, \$49.95; MODEL 711W, Factory-wired, \$64.95. With 300 watts of isolation: MODEL 713K, Kit, \$62.95; MODEL 713W, Factory-wired\$79.95

Printed-Circuit, Voltage- Regulated, Peak-to-Peak VTVM

With Tilting Meter Movement and Magic Lead Switch.

Here's another all-new Precise-engineered instrument, designed with you in mind... to make it easier and more convenient as you test. All-new features include voltage regulation, printed circuitry, etched front panel PLUS the exclusive Meter Movement Tilt that permits you to turn the meter to face eye-level, no matter where you place the instrument on the bench... AND the Magic Lead Switch that permits you to short and open leads automatically for zero or infinite adjustment without removing the leads from the circuit under test! MODEL 904K, Kit, \$34.95; MODEL 904W, Factory-wired, \$49.95



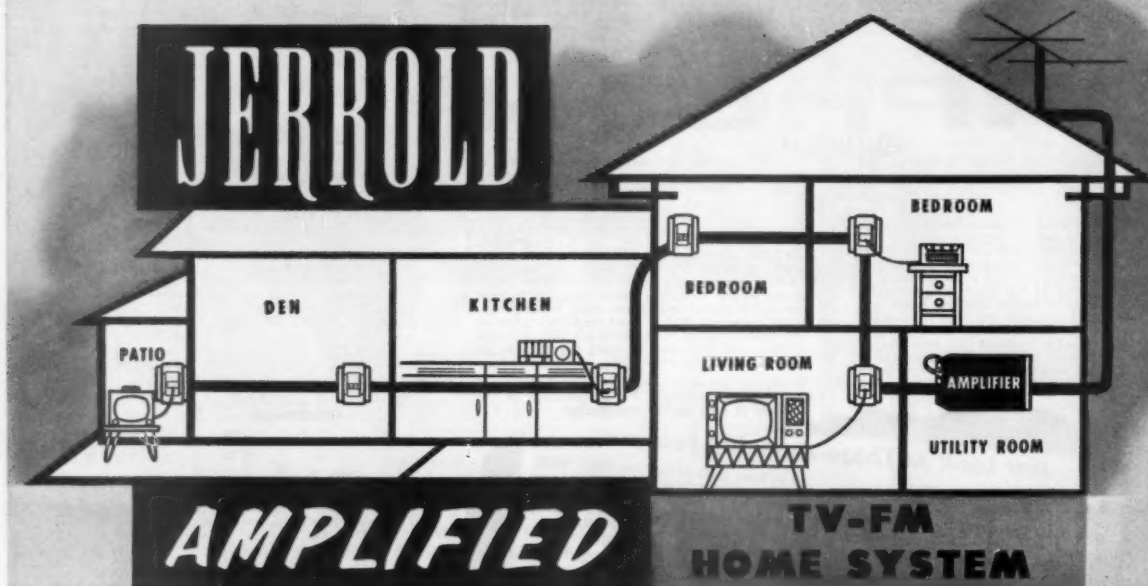
Precise Development's COLOR TV OSCILLOSCOPE

No other oscilloscope at any price, high or low, offers so many desired features! Providing a big 7-inch tube, this fabulous

instrument is designed to help you solve any color TV problem. It contains low-loss components and has an over-designed fused power supply for additional circuitry. You'll find such special features as a Sweep Magnifier, Triggered Sweep Sync Amplifier, Differential Inputs, Gated and Saw-tooth Outputs, etc. This amazing new scope is the result of over 12,000 hours of engineering. It shows more, tells more and lives more than all other commercial scopes. MODEL 300K, Kit, \$99.95; MODEL 300W, Factory-wired\$195.50

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It's Here! The First **AMPLIFIED** PLUG-IN TV-FM HOME SYSTEM



* A Completely Engineered, Fully Amplified System
—Not a Multi-Set Booster

* Simple...Solderless...300 Ohm Twin-Lead Installation

* Sets not "Tied Down", can be moved anywhere

* "Snow Free" TV and "Hiss Free" FM Reception

The FIRST truly engineered, amplified system designed for the home! Supplies Hi Fidelity reception to TV and FM receivers in any room! Makes TV sets truly portable... new TV and FM receivers can be added with a simple plug-in connection!

The Jerrold Home System features a low noise, high output, printed circuit amplifier that increases the TV and FM antenna signals 6 times (15 db). 300 ohm Twin-Lead is used to distribute the amplified signal throughout the home. Receivers are connected to the system by newly designed Home Outlets and Plugs.

The Jerrold Home System opens up a whole new market for the serviceman. It enables him to provide better TV and FM reception in any signal location.

For complete details contact your Jerrold distributor or write to Dept. PD-72

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Jerrold Electronics Corp., Ltd., Toronto, Canada • Export Representative, CBS International, New York 22, New York

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HOME SYSTEM COMPONENTS

HOME AMP... MODEL HSA-46



The 1st printed Circuit TV-FM amplifier. Greatly improves weak signals; flat response across entire (VHF) TV-FM band. Only 2 tubes, designed for 24-hr. operation, consumes only 18 watts. Color compatible, UL approved.

\$4995 LIST

◀ FLUSH OUTLET... MODEL HS-140

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SURFACE OUTLET... MODEL HS-135 ▶

\$195 LIST

The outlets supply clear strong signals without interference between sets. Each includes Perma-Grip plug for TV or FM. Color: Ivory.



No Trimming of Wire Necessary...No Soldering! Quick Screwdriver Installation.



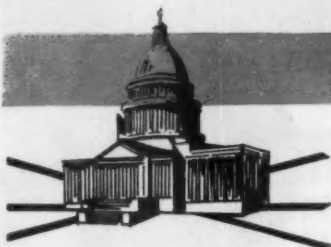
ALSO AVAILABLE
in ready-to-install
kit form

Home System Kit
Model HSK-300

Contains everything (except antenna) for complete 5 outlet system—including Twin-Lead.

\$6775 LIST

For Installation in New Homes and Existing Homes.



**Latest Information
on the Electronic Industry**

Spot News

By RADIO & TV NEWS'
WASHINGTON EDITOR

REVOLUTIONARY TV RE-ALLOCATION PLAN PROPOSED—A long-range (7-10 year) TV-channel program which would shelve u.h.f. and create a new 25-channel slot from 174-324 mc. has been proposed by FCC Commissioner T. A. M. Craven. The shift, which would retain the present 7-13 channels would, it was said, not only eliminate the present v.f.h.-channel shortage, but simplify the design of all-band receivers. As an interim move the proposal suggests that a third v.h.f. channel be added to fourteen areas where there are now only two very-high stations. These areas include Louisville, Syracuse, Rochester (N. Y.), Providence, Jacksonville, Knoxville, Mobile-Pensacola, Birmingham, Grand Rapids-Kalamazoo, Oklahoma City, Shreveport, Greensboro-Winston-Salem-High Point, Wheeling-Steubenville, and Toledo. The new channels could be added, it was claimed, through the use of lower mileage separations and directional antennas.

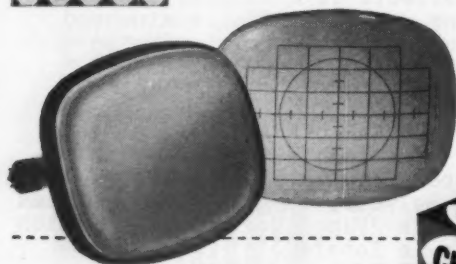
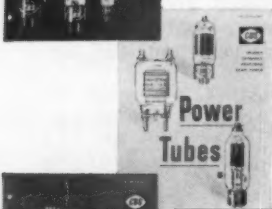
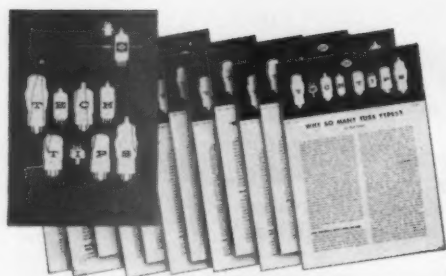
THREE NEW INDUSTRIAL RADIO SERVICES NOW ON FCC BOOKS—The Commission has established three new Industrial Radio Services (in the 450-470 mc. bands): Business Radio, Manufacturers' Radio, and Telephone Maintenance Radio. The first (business) is available to any person engaged in a commercial activity, educational or philanthropic institution, clergymen or ecclesiastical institution, as well as hospitals, clinics, and medical associations. The second service is for manufacturers, while the third was set up for the communications' common carriers primarily engaged in rendering wire-line and radio-communication service for hire. The present Low-Power Industrial Service has been absorbed by the new Business facility, along with elements of the Special Industrial Radio and Citizens Radio Services...In developing these shifts, the Commission re-allocated 6.550 mc. in the 460-470 mc. band from Citizens to Industrial, but retained 2.450 mc. of space in the 460-470 mc. band for Citizens. Pending future developments Class B Citizens stations are extended the right to operate within a 4.950 mc. portion of the band centered approximately on 465 mc.

AMATEUR RULE CHANGE PROPOSED—The FCC announced that it looks toward amending the ham rules (Section 12.111) to provide only A1 transmission in the lower 100 kc. of the 50-54 and 144-148 mc. bands. The ARRL petitioned for the amendment to provide spectrum space free from other types of emission for the investigation of propagation phenomena involving long-distance communication in connection with its project as part of the International Geophysical Year program.

SAC TO CONVERT ALL PLANES TO SSB COMMUNICATIONS—All planes of the Strategic Air Command are being converted to use single-sideband high-frequency equipment. The modification will include B-52 and B-47 bombers and KC-135 and KC-97 tankers. The SSB technique was adopted because it was found to lessen effects of atmospheric disturbance, adjacent-channel interference, and weak or fading signals...Single-sideband has already been installed on the President's plane and several special-mission aircraft. About \$3.5 million has been allocated for the first 900 conversions.

CLOSED-CIRCUIT TV NOW BEING USED BY ARMY TO TRAIN NUCLEAR OPERATORS—A closed-circuit TV system, designed to allow a classroom full of students to observe intricate maintenance functions or radioactive equipment operation in other parts of the plant, has been installed at the Army Reactor in Fort Belvoir, Virginia. The system includes a camera which can be located inside the plant's "Vapor Container" in which the reactor and radioactive high-pressure water system is located.

INDUSTRY RECEIVES RADIO-RADAR CONTRACTS—The government has recently placed multi-million dollar contracts for radio and radar equipment with Raytheon, Texas Instruments, among others. The TI contract covers 50 airport surveillance radar improvement kits and was placed by the CAA.

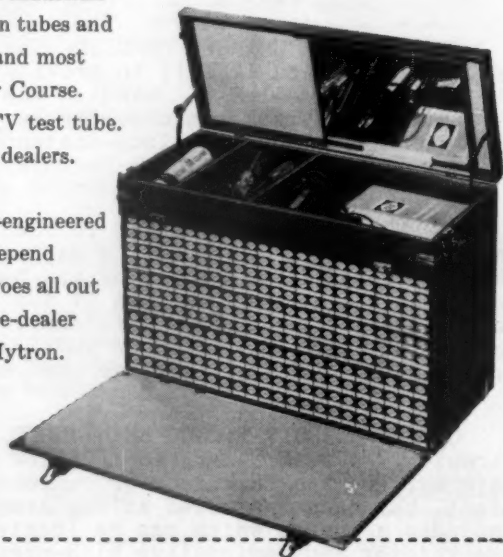


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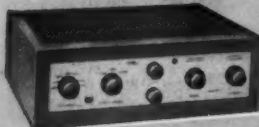
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Stereo Preamplifier HF85



FM Tuner HFT90



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Amplifier-Preamplifier
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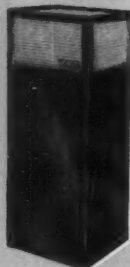
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MONAURAL PREAMPLIFIERS (stack 2 for Stereo)
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HF60: 60-Watt Ultra Linear Power Amplifier with Acro TO-330 Output Transformer; wide band-width, virtually absolute stability & flawless transient response. "One of the best-performing amplifiers extant; an excellent buy." AUDIOCRAFT Kit Report. Kit \$72.95. **Wired** \$99.95. Matching Cover E-2 \$4.50.

HF50: 50-Watt Ultra Linear Power Amplifier with extremely high quality Chicago Standard Output Transformer. Identical in every other respect to HF60, same specifications at 50 watts. Kit \$57.95. **Wired** \$87.95. Matching Cover E-2 \$4.50.

HF35: 35-Watt Ultra-Linear Power Amplifier version of the HF60 above. Kit \$47.95. **Wired** \$72.95.

HF30: 30-Watt Power Amplifier employs 4-EL84 high power sensitivity output tubes in push-pull parallel, Williamson circuit, 20 db feedback, & high stability margin. 2-EZ81 full-wave rectifiers for highly reliable power supply. Unmatched value in medium-power amplifiers. Kit \$39.95. **Wired** \$62.95. Matching Cover E-3 \$3.95.

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HF14: 14-Watt Power Amplifier of the HF81 above. Kit \$23.50. **Wired** \$41.50.

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HF32: 30-Watt Integrated Amplifier combines excellent HF30 power amplifier above with versatile preamplifier featuring tape head & microphone inputs, scratch & rumble filters, all amplifier facilities. Kit \$57.95. **Wired** \$89.95. Both include cover.

HF20: 20-Watt Integrated Amplifier complete with finest preamp-control facilities, excellent output transformer that handles 34W peak power, plus a full Ultra-Linear Williamson power amplifier circuit. "Well-engineered" — Stocklin, RADIO TV NEWS. Kit \$49.95. **Wired** \$79.95. Matching Cover E-1 \$4.50.

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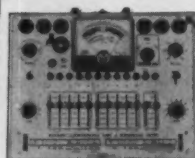
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Entirely electronic sweep circuit (no mechanical devices) with accurately-biased inductor for excellent linearity. Extremely flat RF output; new AGC circuits automatically adjusts osc. for max. output on each band with min. ampli. variations. Exceptional tuning accuracy; edge-lit hairlines eliminate parallax. Sweep Osc. Range 3-216 mc in 5 fund. bands. Variable Marker Range 2-75 mc in 3 fund. bands; 60-225 mc on harmonic band. 4.5 mc Xtal Marker Osc., xtal supplied. Ext. Marker provision. Sweep Width 0-3 mc lowest max. deviation to 0-30 mc highest max. dev. 2-way blanking. Narrow range phasing. Attenuators: Marker Size, RF Fine, RF Coarse (4-step decade). Cables: output, 'scope horiz., 'scope vertical. Deep-etched satin aluminum panel; rugged grey wrinkle steel cabinet.

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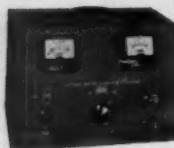


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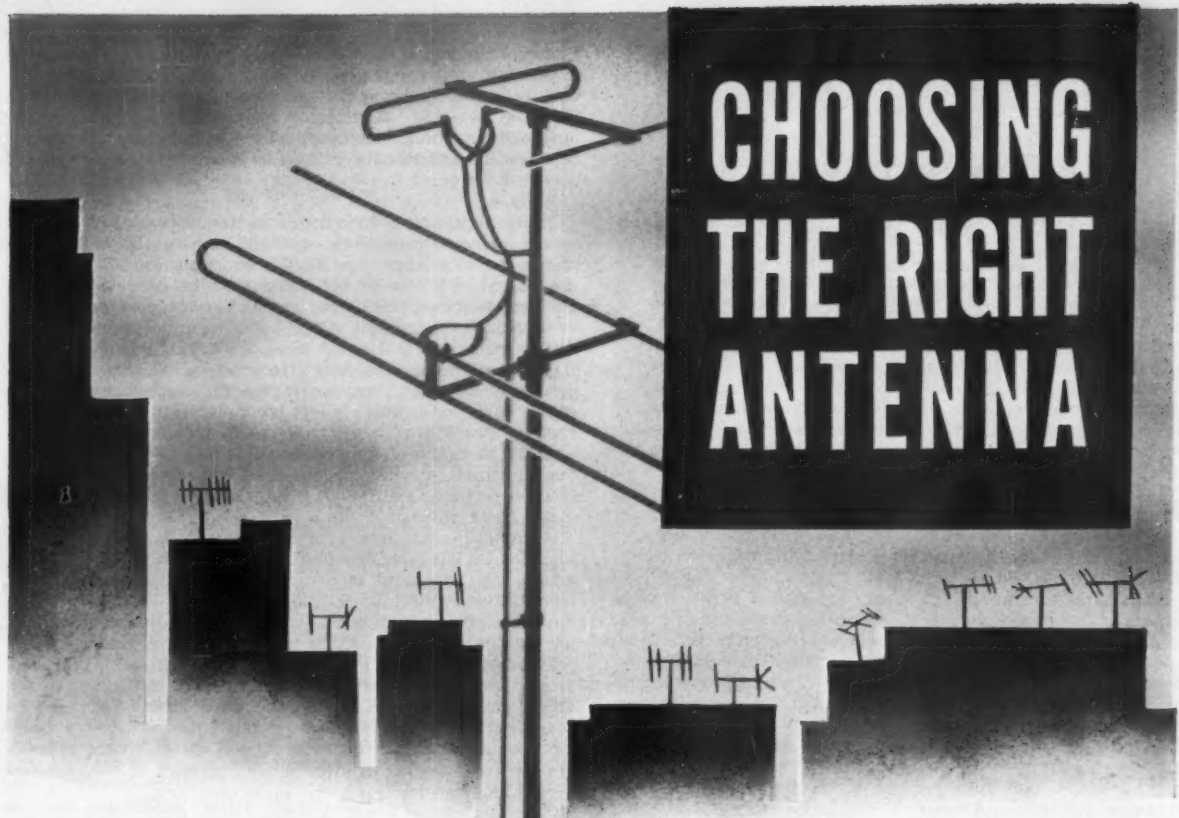
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CHOOSING THE RIGHT ANTENNA

WHEN an antenna has just been wrecked by a windstorm, its owner doesn't have to be convinced that he needs a new one. For that matter, a man who has just been struck by a car doesn't have to be coaxed into letting a doctor have a look at him. Nevertheless, many people carry with them for years slowly destructive although undramatic maladies, refusing to seek help short of the point of collapse. Similarly, the American landscape is dotted with thousands of antennas that have, over the years, deteriorated so badly that they still function as symbols of TV receiver ownership, but very little else.

"The set isn't what it used to be," the owner of such an antenna may say. He may be maligning an entirely satisfactory receiver that is being robbed of hundreds of microvolts of signal or more by a frayed transmission line and corroded antenna elements. The truth never occurs to him. He marvels at his neighbors' newer sets—connected to newer antenna systems—and shakes his head over many things.

He may shake his head over the fine pickup by the set next door of that channel 60 miles away. He has never been able to watch it without eyestrain. He may marvel over the absence of ghosts on his favorite channel. Perhaps it makes no sense to him that someone else gets sharp pictures on two or three sets while he can't get good results on one. If he is a hi-fi fan, it annoys him that a nearby friend gets away with excellent FM and TV reception from the same antenna, while he can't do well on TV alone with his.

Then there's that channel that came on the air about a year after he got his set (and antenna)—why does everyone *else* get it well? Or the favored station that comes in good and strong, but is getting spoiled by another transmitter on the same frequency a couple of hundred miles away.

Poor TV receiver performance? Before blaming the set, find out what a new, properly chosen antenna system will do.

Of course, simple aging or the advent of new designs are not the only reasons for unsatisfactory performance from old antennas. The addition of new sets, at the receiving end, or new channels, at the transmitting end—or the relocation of old channels—may be strong factors in antenna inadequacy. This is far from being a complete catalogue of reasons for such inadequacy.

The important point is that, when reception difficulties exist, many of the millions of Americans who watch TV and have such problems think in terms of the receiver. In most cases, critical appraisal of the antenna system should be the first consideration. The viewer can be taught that such factors as antenna gain, bandwidth, directivity, rejection of unwanted signals, and others are significant.

The "Best" Antenna

Even where the role of the antenna is vaguely understood, the set owner will betray serious gaps in his knowledge. "What is the *best* antenna on the market?" he will ask. We have heard this question countless times. What needs to be done here is a job of education. If the viewer is to learn how much can be done in the way of giving him better reception and what is involved in doing it, his source of information must be the informed service dealer and technician who is capable of spelling out the problems involved.

To answer the set owner's key question, he must be informed that, of the many properties an antenna can have, one unit may be outstanding in some but less good in others. For instance, an antenna may show exceptional sensitivity on one, two, or three channels, but not have sufficient bandwidth to do well on others. In a fringe area where one channel, or two close together in frequency, are the only ones available, an antenna like the one noted may be an excellent choice.

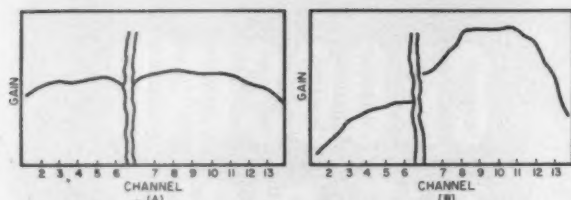


Fig. 1. A broad-band v.h.f. antenna may have good response (A) on all channels. However, local conditions may call for an antenna with superior response on one or two channels (B).

In a metropolitan area however, where many strong signals are available over a wide range of frequencies, a less sensitive antenna with greater bandwidth would be a better choice. Simple diagrams, like the ones comparing two types of frequency response in Fig. 1, can be used to get the point across. Such graphs are plentiful in manufacturers' literature.

Points made in this way are important in conveying the information that, alas, there is no such thing as a single "best" antenna. However, there are such things as antennas best suited for particular applications, once these are understood.

A point a little harder to make, but also of great importance, is the fact that special reception problems are less likely to be solved far removed from the site than they are by informed professionals on the scene. The sum of local experience is generally the best guide. The local technician or dealer has had as much experience with the peculiarities of his service area as anyone else is likely to. The area distributor also becomes familiar with the local situation, drawing on the combined experience of dealers and technicians in his vicinity. Where problems are severe, the field representatives of antenna manufacturers also get into the act. This combination is the viewer's best bet for improved results.

Basic Antenna Types

Before considering reception problems, it is well to discuss the conventional antenna designs in common use. There are also many special designs, or units using the basic configurations in special form, or combining basic types. Nevertheless, it is a fact that most installations in existence involve the standard units.

The simplest antenna, in appearance at any rate, is the indoor "rabbit ears" type, which looks like an upright V. Its relative insensitivity is no problem where signal is plentiful, as in many metropolitan locations. It picks up well from front and rear, receiving over a wide angle in each case. Where available channels come in strong from different directions, this may be an advantage. However, this may make it hard to explain to a set owner in such a location why he may not be able to get the best results with such a pickup device. If his reception suffers from serious ghosts on one or more channels, he can be told something about the nature of delayed, reflected signals quite simply and why they are more prevalent where he is located. He can also understand why an antenna that discriminates against such unwanted signals may be more advantageous. A rough sketch of the narrow pickup pattern of another antenna type (Fig. 2A) compared to the broadly bi-directional pattern of his basic dipole (Fig. 2B) tells the story.

Nevertheless, there are many cases where one version or another of the simple indoor unit is quite adequate. The author knows of a community, located on high ground some 20 miles from a large city, where most residents use indoor antennas. Since all transmissions from the city are roughly in the same direction from this site, there is no need to re-orient the indoor dipole when switching channels. Since there are no other transmitters close enough to pour unwanted signal into this area on the channels received, there is no interference problem. Here is an excellent illustration of the thesis that the particular area determines the "best" antenna type!

Several variations on the basic indoor dipole provide

flexibility that may come in handy in some situations. An impedance matching element is often included to provide best transfer of signal from antenna to set. This may be fixed or variable. A selector switch may be present to optimize impedance or resonance for individual channels or to switch additional elements in or out for best reception.

Folded Dipoles

Many popular outdoor antennas use two folded dipoles as the principal elements—a small one for the high v.h.f. channels and a larger one for the lower portion of the band. Additional directors or reflectors may be used to sharpen the directivity or pickup pattern and to increase gain. One version is the familiar "piggy back," in which the shorter dipole for channels 7 to 13 is at the top of the mast, with the longer one for channels 2 to 6 below it. This type will generally be most sensitive in the forward direction, but shows variation in this respect from one channel to another. Exactly predicting its characteristics from one channel to another is virtually impossible since these traits will vary due to small mechanical or electrical design differences from one manufacturer to another. This may be said of many basic antenna types.

A sometime advantage of this type is the fact that the two dipoles may be oriented independently of each other, which can be useful where available transmissions come from different directions. Like most "high" and "low" combinations, the "piggy back" is not specifically designed for use on the FM band, which is located above channel 6.

In another twin-dipole antenna, the "inline" type, the larger, low-band folded dipole is to the rear of the high-band dipole, with a single dipole reflector to the rear of both. Sensitivity and directivity are fairly uniform over both v.h.f. bands, making this type a good choice where several transmitters operating over a wide spread of frequencies arrive from pretty much the same direction.

Conicals

The conical family of antennas comprises several versions. One basic type uses four elements in the form of an X. In others, six elements are used in a "fan" arrangement. The reflector, to the rear of the antenna, may consist of a single horizontal dipole, another X or fan similar to the forward portion, or a screen.

In general, these receptors show increasing gain as they go up in channel or frequency. For this reason, they may be good choices in areas where signals tend to be somewhat weaker on the upper channels than on the lower band. Since these antennas are sensitive in the region between the two v.h.f. bands, they often appeal to people interested in getting FM reception from the same antenna used for TV.

"V" Antennas

The V-type antennas in popular use fall into two general groups. In the "arrow" type, the forward end of the antenna is a V whose open end faces the direction of transmission. The rear of the antenna is another V faced the same way. In another version, one V is mounted above the other on the mast. While most other antenna types can be stacked for increased gain, this stacked-V arrangement is generally designed and made available as a single, matched unit.

These types are like the conicals in that they tend to give increased gain as we go up in channel or frequency. At the lowest v.h.f. range they tend to pick up somewhat from the rear, being slightly bi-directional. While this would constitute an undesirable front-to-back ratio at the bottom of the TV band in some applications, it could be an advantage where it is desired to pick up a low-frequency channel from one direction and a high-frequency transmission from another, possibly eliminating the need for a rotator.

Also, like the conicals, the V antennas do well in the FM band. Where one wishes to pick up a u.h.f. station of reasonably good signal strength in addition to regular v.h.f. reception, a V unit may prove a good all-purpose, single choice.

Yagis

Known for their high sensitivity and sharp directivity patterns, yagi antennas are generally associated with

fringe-area reception. Their high front-to-back and front-to-side ratios make them useful for suppressing undesired signals arriving from directions other than the one from which reception is sought.

However, conventional yagis, since they have restricted bandwidth, are not recommended for all-channel use. At the low v.h.f. band, standard yagis will pick up one or perhaps two adjacent channels with good results. In the higher v.h.f. band, some are broad enough to pick up more than two adjacent channels. In the u.h.f. band, some broad-banded yagis are available to pick up a number of channels over a given portion of this spectrum. Some special designs based on the yagi principle are intended to provide broad-band operation while retaining the other features of conventional yagis. The standard units are obviously good choices in outlying areas where one channel is barely available, or perhaps two adjacent ones.

U.H.F. Antennas

Apart from the u.h.f. yagis just mentioned, there are other standard types especially suited to u.h.f. reception. Most popular are the "bow-ties" and corner reflectors. The bow-tie is essentially a broad-banded dipole, backed up by a screen-type reflector. The corner reflector uses a dipole element similar to a bent bow-tie, and its rear reflector screen is also bent, into a V shape, with the fold in the screen running horizontally. Both of these types are made for general use across the u.h.f. band.

Design Variations

So much for fundamental antenna types. Special types for particular needs exist in such profusion and variety that exhaustive treatment will not be attempted. The design philosophy that marks most of these is the attempt to retain characteristics found in fringe-area antennas, such as high sensitivity, sharp directivity, good front-to-back and front-to-side ratios, while obtaining coverage over as broad a band of frequencies as possible.

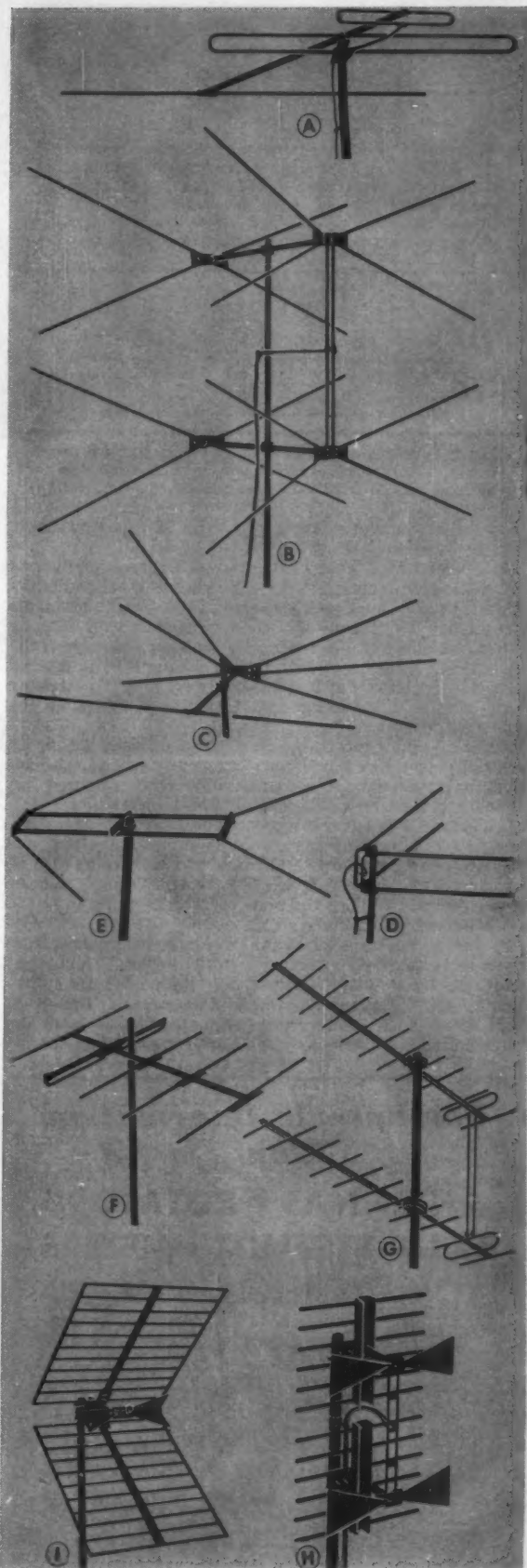
The extra gain needed in the fringe can often be provided by stacking two or more units of conventional design. However, the increase in sensitivity is not a simple linear function of the number of antennas stacked. Additional gain provided becomes less with each new unit added and matching problems increase. It is generally not advisable to stack more than four antennas. In areas where available signal is extremely weak, it may be necessary to begin with high-gain types and then attempt stacking. Also, stacking presents certain physical problems that will be noted later.

Of the special designs, some represent adaptations and combinations of conventional units and others are represented as working on entirely different principles. The best way to assess their characteristics in terms of particular needs is to check the descriptive literature available for these units, including specifications. A check with the local distributor's knowledge of the experience technicians in the vicinity have had with these units, and with the opinion of manufacturers' field representatives, are also useful in reaching a decision.

Reception Problems

With the great variety of antennas available, how does one make a choice? The viewer must first decide on what kind of reception he wants and, short of that, what he may have to settle for. He must work this out with his service dealer in order for both to work in the desired direction with mutual understanding. This is where the dealer's

(A) The inline antenna, which uses a high-band folded dipole and a similar low-band dipole. Another "high" and "low" dipole antenna is the "piggy back," shown on page 37. (B) A two-bay, stacked version of the 4-element conical, also using 4-element reflectors. (C) A single 6-element or "fan" conical, with a horizontal dipole reflector. (D) One version of the stacked-V. (E) The flying-V or arrow antenna. (F) A 5-element v.h.f. single-channel yagi. (G) Two u.h.f. yagis, stacked for higher gain. The presence of additional elements in each yagi also increases sensitivity. (H) A pair of u.h.f. bow-ties with a screen reflector. (I) A corner-reflector antenna for u.h.f.



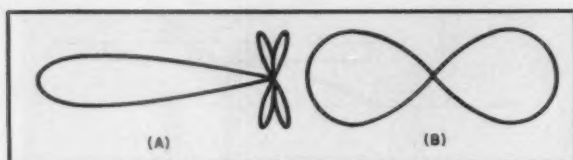


Fig. 2. A sharply directional sensitivity pattern (A) will provide superior gain and discriminate against unwanted signal from the wrong direction. A broadly bidirectional pattern (B) will pick up well enough from many directions, but will generally provide less gain.

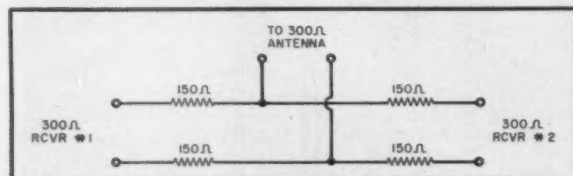


Fig. 3. A two-set coupler like one shown can be made up easily. It will maintain impedance match, but signal to each set will be down 6 db. Use non-inductive resistors.

presentation of the existing problems in understandable form becomes important.

If TV-only v.h.f. reception is desired, immediately one may discard antennas that do well in the FM range if they sacrifice performance on TV. Some of the specific problems of combined TV-FM or v.h.f.-u.h.f. reception have already been acknowledged in the discussion of antenna-type characteristics. Where a wide range of frequencies is desired but weak signals are available, the choice between stacking broad-band units or using different types to break up the spectrum desired can only be made on the basis of local experience and experimentation. The angle over which sensitivity is desired will also determine whether broad-band, narrow-band, or separate, differently oriented antennas are used or whether a rotator is desirable.

If a color-TV receiver is a present or future consideration, the gain requirement may become more important and linearity of response over individual channels must also be considered. Additional gain requirements must also be considered where more than one receiver is going to be fed from the same antenna system.

In many cases, serious interference originates from some local source such as a nearby hospital, industrial plant, or other installation using equipment that may radiate r.f. Fortunately, where this occurs, the point from which such interference originates is seldom in the same horizontal plane as the desired signal. An antenna

whose pickup pattern is sharp in the vertical direction would be helpful in discriminating against such undesired r.f. Vertical stacking usually improves the vertical directivity characteristic, even in the case of ordinary antennas.

While we have scarcely covered all possible reception problems, at least we have indicated how they can be handled with known antenna techniques.

Physical Considerations

While we have dwelt on electrical performance, there are many mechanical factors that must be considered in choosing an antenna. Manufacturers have also learned a great deal over the years about improving durability. Special mixes of aluminum or anodizing are used to safeguard elements against a variety of corrosive weather conditions such as the salt-moisture content in coastal areas, smog, and other impurities found in the air. The important spacing insulation, used in some designs, has been improved so that it is not so sensitive to weathering or the accumulation of foreign deposits.

Supporting and bracing of elements to withstand the effects of wind and vibration have also improved over the years. This is important where high winds or heavy snow and ice accumulation are a problem. Where wind is a problem, it may be a good idea to avoid antennas whose elements are disposed in the vertical plane, or vertically stacked arrays, unless they are carefully supported. Ice and snow accumulation, however, will generally be more serious with horizontally disposed units.

Auxiliary Equipment

Masts, rotators, transmission lines, preamplifiers, mounting hardware, couplers, and the like certainly need careful consideration, but they merit independent treatment. Masts and towers, where extra height is desired, will often depend on the ground area available for their erection. Guying can be used where space is available, but special self-supporting towers may be needed for smaller areas. Many crank-up towers or others of adjustable height are available. These come in handy where, due to layering, special terrain problems, or other effects, signal strength varies erratically with antenna height.

In cases like the one just noted, and others where erratic signal availability is encountered, a field-strength meter will be a desirable instrument to use, especially where signals are so low that every last microvolt is eagerly sought. A test receiver is often employed for determining the best point of antenna location and orientation, but this system has drawbacks in critical cases. Due to a.g.c. action and other effects, the relationship between the quality of reception and signal in the antenna is neither linear nor absolute. An antenna arrangement that will provide good performance on the day of installation may be unsatisfactory the following day if the weather changes. Anticipating such variations in signal availability, the field-strength meter can be used to look for an antenna position that will provide some reserve signal beyond the minimum required to produce satisfactory performance at the particular time of installation. A test receiver cannot make this important difference sufficiently apparent.

Couplers are available in a variety of resistive or inductive types, or combinations of these two. Primarily, they attempt to maintain good match to the antenna and all receivers involved. They vary with respect to the amount of signal loss they introduce and the isolation between one set and another. If adequate signal is available, a simple, two-set coupler can be made up of four resistors, in the configuration shown in Fig. 3. It will retain the necessary match to the antenna system, but introduces a 6-db loss of signal to each set. It also provides fairly good isolation between sets.

Returning to our original premise, there is no such thing as a one best antenna for all uses. Nevertheless, with mutual understanding between service dealer and set owner as to reception goals, much can be achieved. It is true that thousands of people now tolerating unsatisfactory reception can either eliminate their problems entirely or obtain substantial improvement with intelligent application of available methods.

For Specific Information on ANTENNAS • ROTATORS FIELD-STRENGTH METERS TOWERS • ACCESSORIES

Write Direct to the
Manufacturer

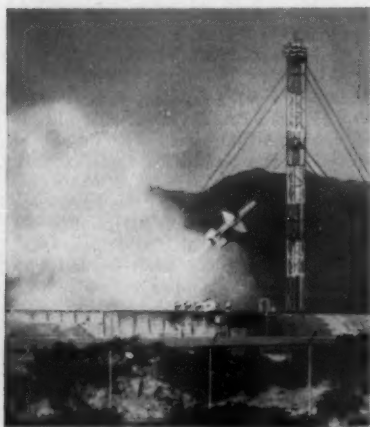
All advertisers appearing in this
issue have indicated a desire to
help Readers of **RADIO & TV NEWS**
with their immediate problems.

World's Most Accurate Radar

AWARD of the prized Navy Certificate of Merit to *Radio Corp. of America* for development of the first completely automatic missile firing and guidance system was announced recently. The newly created award is the highest civilian honor the Navy can bestow. The missile system cited is the Talos Defense Unit, built at White Sands Proving Ground, New Mexico by *RCA*. One of the largest and most comprehensive electronic weapon systems ever devised, the Talos unit is now undergoing evaluation by the Army. The complex system was brought to the evaluation stage in one-half the time normally required for a project of this magnitude. All features of the system have been tested satisfactorily.

Instrumentation Radar

The "all-seeing eye" of the defense unit is the precision type AN/FPS-16 radar. This unit is the result of a ten-year program of research and development carried out in conjunction with the Applied Physics Laboratory of



↑ Talos missile being fired during test at White Sands Missile Range, New Mexico. The target drone, flying far down range at medium altitude, was shot down.

Heart of the Talos Defense Unit is → the Fire Control Center. The main console (center, rear) uses 3-color video display system based on color television technique.



Close-up view of the antenna pedestal of the highly accurate instrumentation radar.

Helps RCA win Navy award for first wholly automatic missile firing and guidance system.

Johns Hopkins University. The new radar, designed especially for guided missile test range use, will supplement or replace the less accurate World War II surplus radar which has been in use since 1945 at the several proving grounds of the Department of Defense. The radar is also being used for the Vanguard Satellite Program.

The instrument, which can be controlled by a single operator, will automatically acquire targets designated by the operator or other equipment on the range and, having acquired its target, the radar will track automatically in all three coordinates. It can also be used to control the flight of drone air-

craft during all-weather, or day or night use. The position accuracy exceeds that of any other known radar, permitting the pinpointing of a target within $\frac{1}{200}$ th of the radar beam width. At present the unit can track aircraft or missiles to about 290 statute miles, with a possible increase to beyond 500 miles by the addition of a modification. The radar furnishes digital data accurate to few feet in range and $\frac{1}{200}$ th of a degree in angle, for instantaneous use by automatic digital computers. Special built-in test equipment can locate trouble sources, and repairs can be made in minutes due to the ready availability of each chassis.

-50-





Audio "Mix-It" Box

By LEON A. WORTMAN

Operating panel of the "Mix-It" box is shown here. With cover in place, unit is portable.

IF THE signal is at an audio frequency, this versatile mixer-pre-amplifier can handle it very nicely. In fact, it will "handle" four separate audio signal sources at one time. With it, the operator can mix or blend or balance such diverse signals as those from these sources: low-impedance microphone (50 to 250 ohms); high-impedance microphone (above 500 ohms); reluctance-type phono cartridge; and utility (bridging) from any impedance source. Yes, microphones, tuners, tape players, phonographs, oscillators, or radio lines—high or low gain, high or low impedance—whatever the source, the "Mix-It" provides an excellent means of controlling signal level with both visual and aural monitoring.

This versatile mixer-preamplifier will handle four separate audio signal sources at one time.

Included in the circuit are: a db meter and meter attenuator, a phone jack, output terminals, plus all manual controls mounted on the front panel for easy handling and viewing. The output terminals are three thumb-screw binding posts. One is common and isolated from the chassis, the other two are for connection to an 8-ohm voice coil and a 500-ohm line. All input connectors are at rear of cabinet.

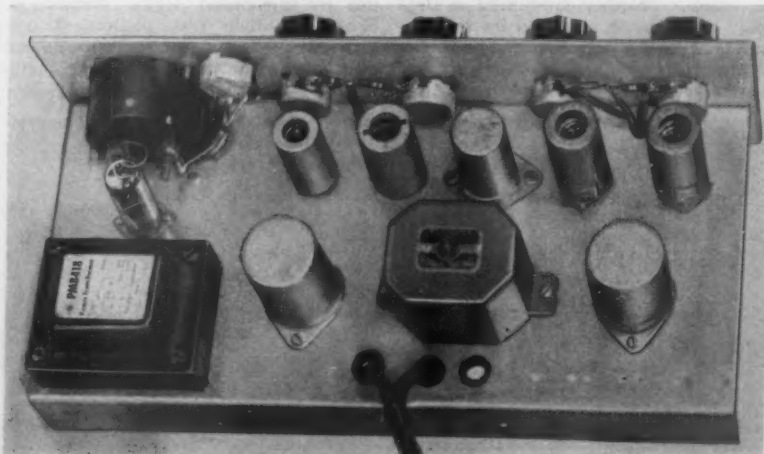
Power is provided by a built-in transformer-type a.c. supply. The entire "Mix-It" box measures only 14" wide, 8" deep, and 5" high when closed in its

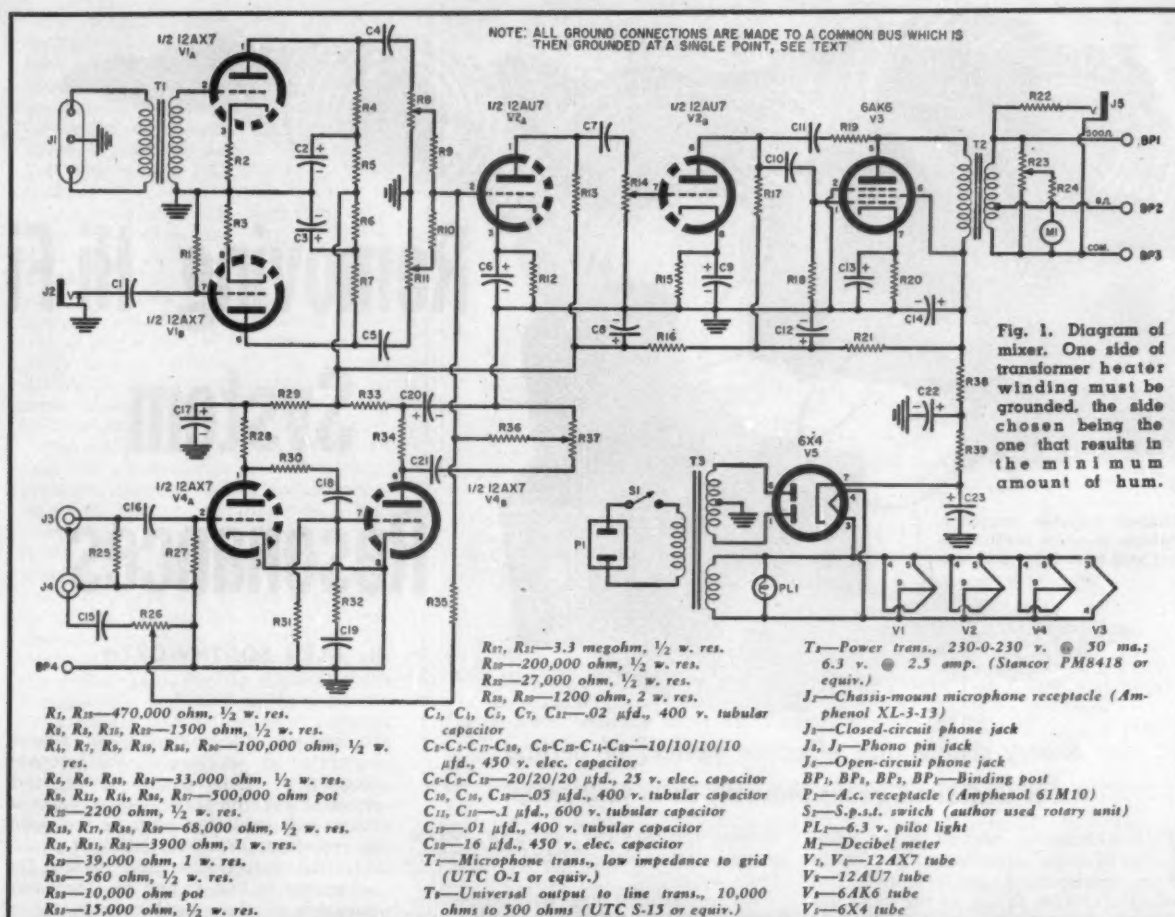
carrying case. You see, it is portable too! Total weight is a mere 7 pounds.

The chassis is a standard 13" x 7" x 1½" open-end aluminum unit. The cabinet is a fabric-covered wood box obtained from a local photo-supply store at very low cost. The box was originally designed as a carrying case for a 35 mm slide projector. The inside dimensions proved ideal for the standard chassis being used. The panel was cut from aluminum stock to fit the front opening of the carrying case. Other cases can be used, of course, in conjunction with standard-size aluminum or steel chassis. The panel is secured to the chassis by the hex nuts of the "on-off" switch, pilot light, master gain control, and the hardware of the output terminal strip. For an attractive and distinctive appearance, after the panel had been drilled and cut, the panel was sprayed with gold lacquer. One of the handy spray cans, available at radio parts houses and many hardware stores, was used for the purpose. Other colors, such as the familiar grays and blacks, and hammertone sprays are also available. Their application is simple and certainly enhance the appearance of the equipment.

The tube line-up and functions are as follows, referred to the schematic diagram of Fig. 1: V_{1A} preamplifies the low-impedance microphone-level signals from input transformer T_1 ; V_{1B} preamplifies the signals of the high-impedance microphone or crystal-type

Top-chassis view of the unit shows that all tubes, except rectifier, are shielded.



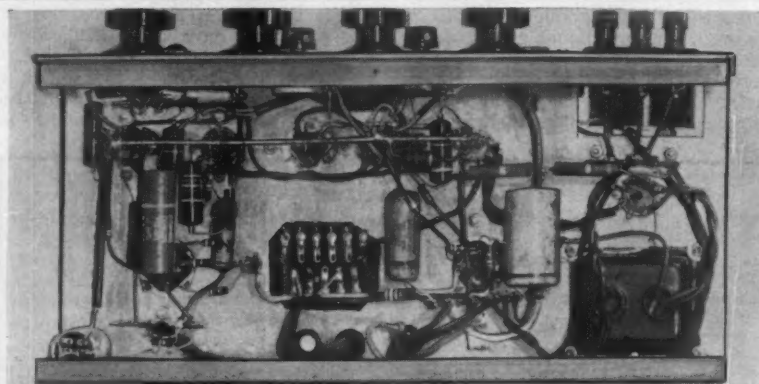


phono cartridge; V_{4A} and V_{4B} preamplify and bass-compensate the output of a reluctance-type phono cartridge; V_{4A} and V_{4B} are in series-connected circuits as voltage amplifiers driving V_5 , a 6AK6 power pentode. Maximum audio power output available is approximately .8 watt into a 500-ohm load; V_6 is a 6X4 full-wave rectifier tube for the power supply.

The "Mix-It" box was originally constructed for use with a remotely located tape recorder of professional quality, therefore the db meter, meter attenuator, and multiple outputs were required. These features are not often found in equipment other than that designed for commercial recording or broadcast work. The db meter and meter attenuator enable the "setting of levels" when the operator of the "Mix-It" and the recorder are physically separated. This permits the adjustment of volume controls during a "feed" or a "pickup" for optimum performance with respect to distortion (by controlling possibilities of overloading) and background noise (by maintaining a relatively high minimum level of the audio signal consistent with good dynamic range). Frequency response of the "Mix-It" is shown in Fig. 2.

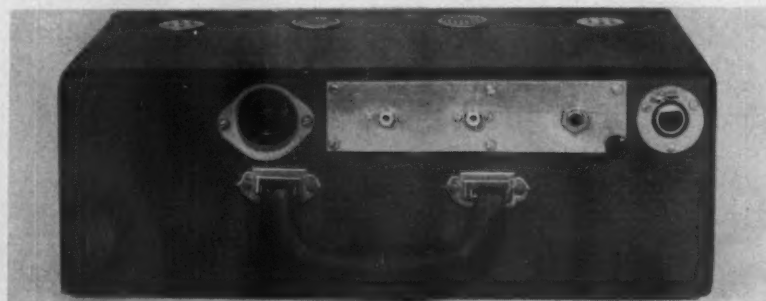
The output level of the "Mix-It" is sufficient to drive a small monitor

(Continued on page 99)



Bottom-chassis view of the audio "Mix-It" unit. Note use of a ground bus.

At rear of the carrying case are the power plug and various input jacks.





Compact variable frequency, variable rejection audio traps that tune from 30 to 3000 cps.

Removing Hi-Fi System Resonances

By GLEN SOUTHWORTH

A very simple and effective method of getting rid of undesired peaks that may be in your setup.

THE widespread interest in the influence of audio amplifier output design on loudspeaker performance has called attention to one of the most important problems remaining in the field of high-fidelity reproduction. This is the matter of objectionable mechanical resonances that may occur in one or more of the elements of the reproducing chain and includes such possible sources as loudspeakers, enclosures,

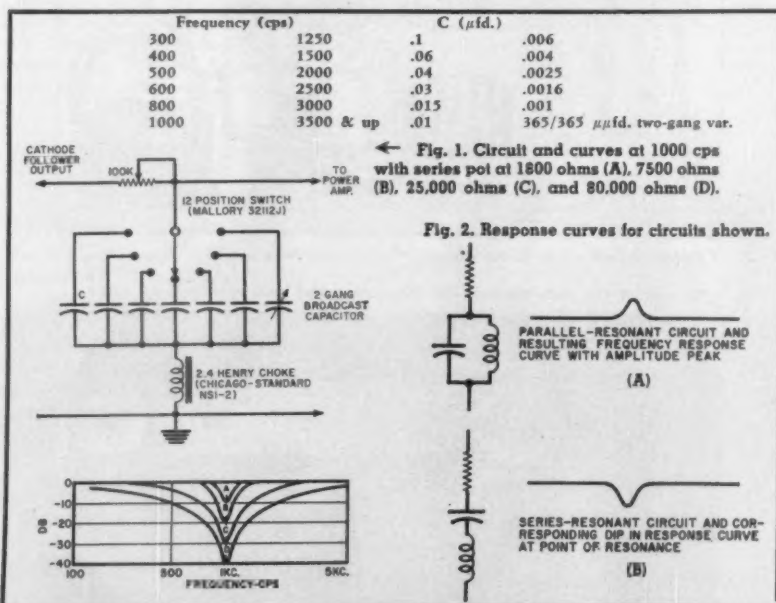
phonograph pickups and arms, microphones, and at either end of the system, room acoustics.

All resonances are not necessarily objectionable, depending upon individual tastes. On many occasions in the past they have been deliberately introduced, either in equipment or program material, in order to provide a more "salable" product. In general, the most noticeable effect of resonance is

to increase the audibility of sounds occurring at, or close to, the resonant frequency. This occurs in several ways: First, the steady-state response curve will exhibit a peak at the point of resonance. Second, pulses or short-duration wavetrains may cause the resonance to "ring" and the increased duration of the sound may be interpreted by the ear as increased loudness. Third, if the resonance occurs early in the system, the amplified waveforms which result may be reproduced more efficiently by a loudspeaker with poor transient response.

A number of secondary effects may also be produced by uncontrolled resonances. These include the well-known "boominess" caused by low-frequency resonance, a "tom-tom" effect produced by mid-frequency resonance, and shrillness plus accentuated high-frequency noise resulting from resonance in the upper audio registers. Another difficulty arises if amplitude non-linearity occurs in any part of the system following the resonant element since more serious intermodulation distortion may result when reproducing complex program material.

It is unfortunate that power amplifiers with high damping factors are the most effective in suppressing what should be one of the least objectionable resonances in the system. This is the loudspeaker primary cone resonance which, in most high-quality units, occurs at the bottom of the audio range in the region from 25 to 90 cycles, depending upon speaker size and manufacture. Frequently these speakers are well damped mechanically and what resonance remains at this low frequency is often useful in providing some degree of "warmth" under ad-



verse acoustic conditions. However, the speaker usually exhibits a high degree of efficiency at the point of primary resonance and the movement of the cone causes a correspondingly high voltage to be generated in the voice coil which is "short circuited" by an amplifier with a low effective output impedance.

Annoying mid- and high-frequency-range resonances are rarely affected, if at all, by a high amplifier-damping factor for a variety of reasons. Poorer speaker efficiency at off-resonant frequencies and semi-independent vibration of some part of the cone are two likely causes. Similarly, the speaker enclosure itself may be at fault for some reason and the amplifier is apt to be of little help in this situation.

The individual constructor or listener may find a promising approach to these problems through use of anti-resonant elements in the amplifier which will compensate for deficiencies elsewhere in the system. In this case simple combinations of resistance, capacitance, and inductance are employed in order to reduce the audible effects of mechanical resonance occurring in the loudspeaker, enclosure, or other part of the audio chain. Fig. 2A illustrates the steady-state response curve produced by a simple parallel-resonant element with a peak in the curve occurring at the point of resonance. Fig. 2B shows the corresponding curve of a series-resonant circuit tuned to the same frequency and the corresponding dip in output at resonance. It is fairly obvious that if an anti-resonant circuit is included in the amplifier and the amplitude and frequency of the dip properly controlled then the resulting response curve will be nearly flat.

It might be suspected that although this expedient would appreciably improve steady-state performance, it would be of little value in suppressing or "damping" spurious wavetrains produced by transient shock excitation. In practice, this does not seem to be the case and, if the anti-resonant circuit precedes the unwanted resonance, the transient signal appears to be "shaped" in such a manner as to minimize spurious ringing. Fig. 6 is a series of oscilloscope traces illustrating this effect. Fig. 6A shows the initial pulse input

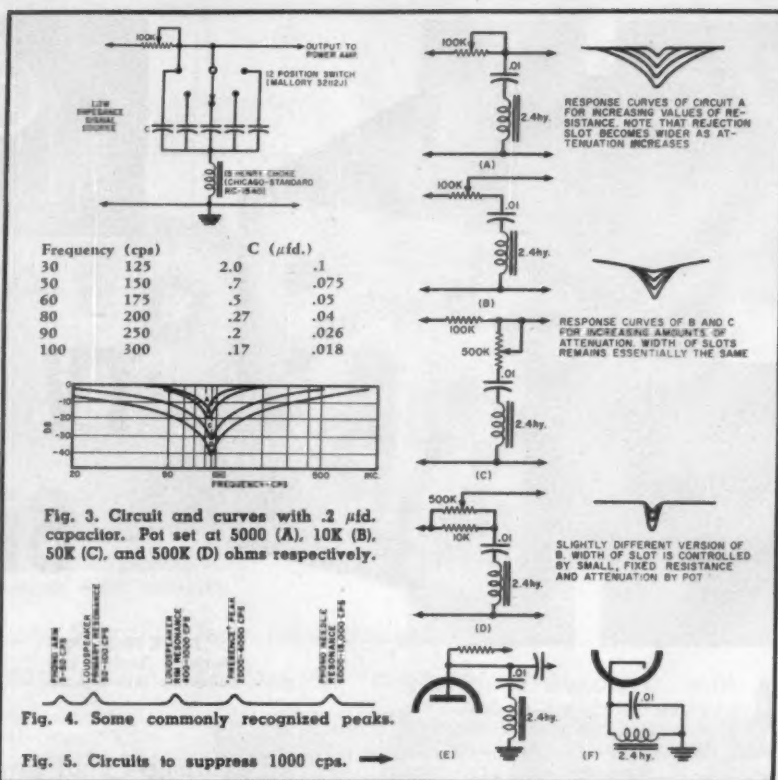


Fig. 3. Circuit and curves with .2 μ fd. capacitor. Pot set at 5000 (A), 10K (B), 50K (C), and 500K (D) ohms respectively.

Fig. 4. Some commonly recognized peaks.

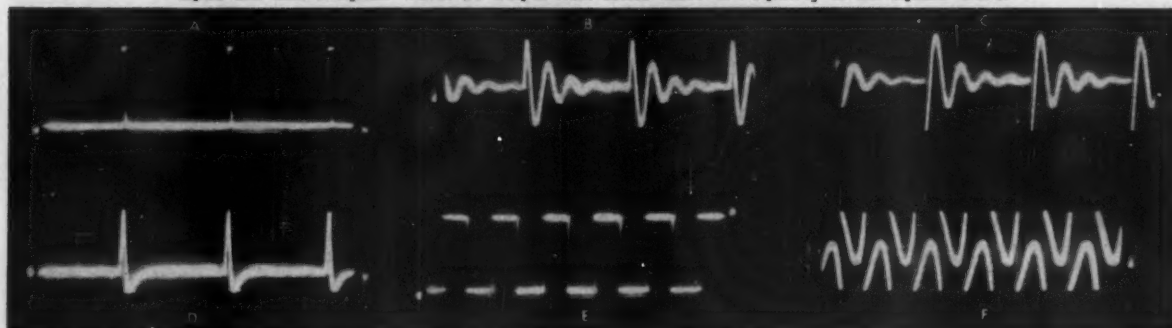
Fig. 5. Circuits to suppress 1000 cps.

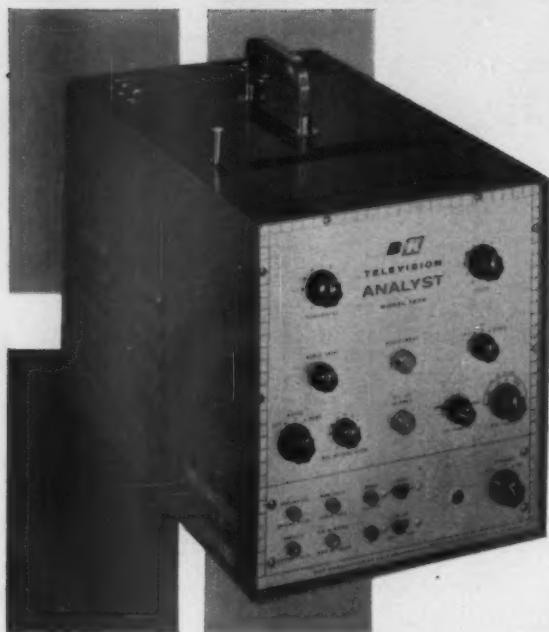
signal, while Fig. 6B demonstrates the consequent ringing produced by a moderately damped parallel-resonant circuit. Fig. 6C is somewhat unusual in that it pictures the out-of-phase ringing of a series-resonant circuit, a wavetrain that is the reverse, in polarity, of that produced by the more common parallel resonance. Fig. 6D illustrates the result of passing the initial pulse first through the series-resonant circuit and then through the parallel-resonant element. Although the output is not an exact replica of the input pulse, considerable progress has been made toward minimizing spurious ringing. Using a slightly different approach, Figs. 6E and 6F show a square wave of the same repetition rate as the resonant elements and the inversion caused by the series-resonant circuit.

The use of a tone-burst generator, oscilloscope, and associated equipment makes it possible to precisely identify resonances occurring in a reproducing system. However, the procedures are somewhat time-consuming and the equipment is not likely to be available to the average listener. A much simpler, and probably just as satisfying, technique is to employ a tunable series-resonant filter and adjust the component values for maximum clarity and naturalness when listening to speech and music on a particular high-fidelity system. Fig. 1 is the schematic for a simple device of this nature which is intended to be inserted between the preamplifier-control unit and the power amplifier of a conventional hi-fi setup. "Tuning" is achieved by means of a

(Continued on page 152)

Fig. 6. (A) Electrical pulse signal applied to resonant circuits. (B) Response of low-"Q" parallel-resonant circuit. (C) Output of matching series-resonant circuit. (D) Result of passing pulse first through series circuit and then through parallel circuit. Note greatly reduced "hangover." (E) Another input, this time a square wave. (F) Output from series tuned to frequency of the square wave.





A NEW APPROACH to television servicing technique is made possible with an instrument introduced by B&K Manufacturing Company. To speed up the troubleshooting procedure, a signal-injection method was developed in which the defective stage of a TV receiver can be isolated in a few minutes.

The basis of the entire system is that, when we inject the proper signal at any point in a TV receiver, we are automatically testing all of the stages and circuits between that point and the output portion, whether it be picture tube or loudspeaker. By looking at the display on the picture tube or listening to the output from the loudspeaker, we can determine whether the particular circuits being tested are "good" or "bad." The injected signal, however, must be such that the display seen on the picture tube is subject to relatively easy analysis so that interpretation of waveform or other patterns is not usually necessary.

For the injected signal, a complete test-pattern image is employed. After all, what is more recognizable than a complete TV picture display? As a matter of fact, the B&K Model 1075 Television Analyst does use a video test pattern to help make any deficiencies in the circuits being tested more readily apparent.

Using this method, the service technician can inject an appropriate signal practically anywhere along the normal series path of the signal from the antenna right through the video amplifier. By starting at the video stages (and injecting a video signal), then working back through the i.f. stages (with an i.f. signal), and finally through the r.f. tuner (with an r.f. signal) to the antenna, the complete progress of the signal as it goes through the set can be checked. Any break or discontinuity of

the signal as it is fed in at these various points calls immediate attention to a defective section, stage, or component.

As an example, let us assume that we have applied a 45-mc. i.f. signal to the grid of the 3rd video i.f. stage shown in Fig. 1 (a modulated 25-mc. i.f. signal is alternately available where needed) and that we obtain a clean test-pattern display on the picture tube. However, when we apply the same signal to the grid of the 2nd video i.f. stage, we get a very poor picture or none at all. Immediately we know that the trouble is somewhere between the grids of the 3rd i.f. stage and the 2nd i.f. stage.

Even more valuable than this relatively simple determination is the fact that we can actually use the same instrument to go further and test some components. If we inject the same 45-mc. signal at the plate of the 2nd i.f. stage, we can test transformer T_1 ; for, if the transformer is open, no signal will pass through it and no pattern will be displayed on the TV screen. If the transformer is good, the test pattern will appear and the trouble would then be sought in the screen circuit, "B+," or the tube itself—unless the tube has already been checked, as is usually the case, before the troubleshooting procedure was begun.

A simple check with a voltmeter will tell whether the plate and screen are getting proper "B+" voltage—but how would you check to see whether C_1 , the screen bypass capacitor, is open?

If C_1 is shorted, we can tell because screen voltage will be very low or absent. However, to decide it is open, we would have to replace it or at least partially remove it from the circuit. Once again, by using the Television Analyst, we can accomplish a rapid in-circuit test. The i.f. signal is simply injected directly at the screen grid and the picture-tube display is observed. If C_1 is a good capacitor, it will bypass most of the signal to ground and only a very weak or snowy test pattern will be displayed. However, if C_1 is open, the full signal will be applied to the tube via its screen grid and a clean test pattern will appear on the screen of the CRT!

This is only one illustration of the manner in which an instrument like the Model 1075 can be used to obtain results in minimum time. The composite signals available from this instrument include r.f., i.f., video, 4.5-mc. audio i.f., 400-cycle audio, 3.58-mc. color rainbow, and also horizontal and vertical sweep driving pulses.

Practically any section of a TV receiver can be tested quickly to isolate the troublesome stage and, as demonstrated, single defective components can often be pinpointed. Once he is familiar with the technique involved, the TV technician can also save much of the time and frustration involved in isolating intermittents too. Time saved means more sets serviced per day. To any technician in business, this means a chance to make greater profits. —(30)—

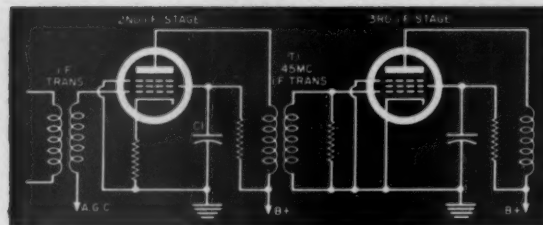


Fig. 1. In addition to isolating trouble to stages like the ones shown, the Analyst pinpoints components.

TV Analyzing —Simplified

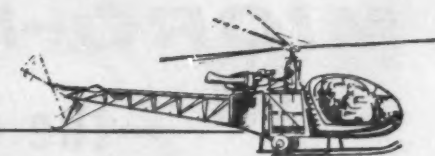
B & K Model 1075
Television Analyst provides numerous test signals.

By MILTON S. KIVER

An instrument that involves its own streamlined troubleshooting technique, saving time and effort.



Antennas atop mobile command post truck are for rescue frequencies.



Radio Aids Rescue Operations

Los Angeles County Sheriff's Dept. uses ground-to-air radio from mobile command post in order to speed rescue operations.

UNDERSHERIFF Peter J. Pitchess (above) demonstrates the versatility of the Los Angeles County Sheriff's Department's communications. With ground to air radio, the Sheriff's 3 helicopters can relay information as to the location of any heavy damage area or the location of missing persons, and the command post can send radio cars or rescue teams on foot or horseback with walkie-talkies. With the mobile command post, the helicopters, and ground units all linked by radio, data can be relayed instantly, and all units informed as one.

The mobile command post (a modified *International* bus) is completely self-contained. Either one of two portable motor generators will take care of all electrical needs, which includes seven radios (*Motorola* 60-watt units) and *Bell* mobile telephones. The vehicle is equipped with radios on the standard Sheriff's frequencies (29.26 mc., 39.74 mc., 37.26 mc), the California Highway Patrol's frequency (42.43 mc.), the Los Angeles County Fire Department's frequency (154.43 mc.), and a Civil Defense frequency.

The Sheriff's Department, in addition, makes use of a mobile radio station, with a 250-watt station transmitter, which also helps provide links to the radio patrol cars, aircraft, rescue boats, and other facilities.

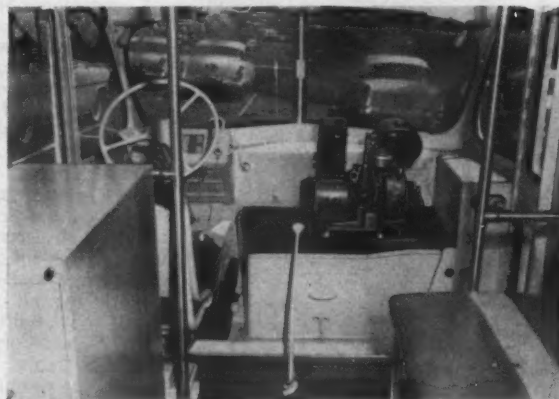
The mobile command post has enough reserve power to permit limited lighting of a small building that might be required for hospital, operating room, or message head-quarter purposes. There are living quarters for a crew of three, including such essentials as sleeping and cooking facilities, water, sanitation, and electric refrigeration. The refrigeration is also adaptable for the storage of medical serums and plasma that would be needed in an emergency.

The most recent use of this vehicle in disaster service was in the Malibu fire last year. There, in the vicinity of Point Dume, this radio station controlled the radio operation of the Sheriff's cars in the fire area for about eight days continuously. Three regular radio dispatchers were assigned to operate "around the clock."

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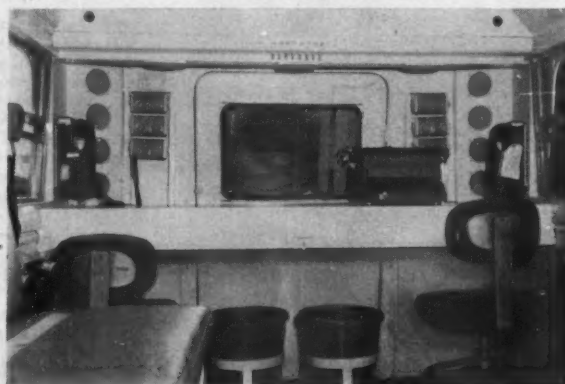
THIS MONTH'S COVER

THIS month's cover shows a helicopter, after having just picked up an injured hiker, being directed to a nearby hospital by the mobile command post truck. Doctors at the hospital, previously alerted by a call from the L.A. Sheriff's Department, are awaiting the victim's arrival. (Photograph by Peter J. Samerjan.)



View looking out front windshield shows one of the gasoline-powered generators. This supplies voltage needed to recharge the batteries used for all radio equipment in the command post. It also supplies power for all interior and exterior lighting.

View looking toward rear window shows two-man operating position. Small boxes mounted beside window are control units for some of the radio equipment. Eight built-in speakers may be seen in the corners behind the two field telephones.



MICRO-MODULES

—the Ultimate in Miniaturization

By T. E. GOOTÉE

Electronic equipment of the future will be lighter in weight, smaller in size thanks to this technique.

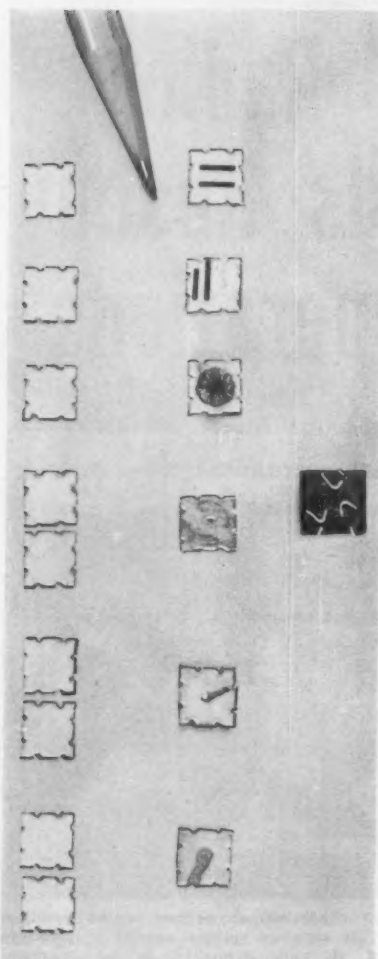


Fig. 1. Evolution of a micro-module in actual size. The basic wafers are at left. Next, from top to bottom are the following wafers: resistors, resistors, coil, capacitor, transistor, and diode. The complete micro-module is at the right.

THE electronic and radio-television industries today are at the threshold of a new and revolutionary change in the design and manufacture of component parts for equipment.

So great is this change that, ultimately, it will affect the size and weight of *all* electronic, radio, television, and other communications equipment—with possible reductions to one-tenth or more.

The objectives of this revolutionary change are reduced size and bulk and decreased weight. These objectives are met through *micro-miniaturization* and the production of *micro-modules*.

Conventional transistors and miniature parts being used in today's radio and television sets and other electronic and communications equipment are not small enough for the purpose. There is a need for a further decrease in size, bulk, and weight—requirements that are responsible for the startling research and design advances in micro-miniaturization.

Although ultimately applicable to all kinds of electronic and communications equipment, the present program of research and design was triggered directly by the urgent need for compact, lightweight equipment for the Army Signal Corps. This requirement runs the gamut from small portable radios to complex trunk switching centrals, from television sets to electronic data processing equipment, and even to satellite instrumentation. Here, in a military environment, was and is the urgent need for extreme miniaturization.

After months of theorizing, exploratory tests, and experimental design, in cooperation with American industry,

the Army Signal Corps has now reached the stage where actual development contracts have been placed—notably one with *RCA* for five million dollars. An "industrial preparedness measure," this marks only the start toward refinement and utilization of multi-function micro-modules.

Micro-Assemblies

The key to the future program of micro-miniaturization is the fabrication of extremely small, solid-state devices, known as micro-modules.

Although micro-modules can be constructed in any physical shape of cover or envelope, most common will be the standardized type shown at the right in Fig. 1. This is a complete part composed of a number of sub-assemblies, each constructed in a common wafer shape.

The wafer may be of ferrite, barium titanate, or even metal, as required. Each wafer measures 3/10 inch by 3/10 inch and is only 1/100 inch thick. Miniature elements of a sub-assembly are selected and arranged to provide a specific circuit function.

For example, as shown (from top to bottom) in Fig. 1, these sub-assemblies could be a number of resistors, a coil, capacitor, transistor, or diode. When these particular sub-assemblies are stacked together, they form a complete micro-module—in this case the tuning, detecting, or amplifying stage of a five-stage broadcast-band radio receiver.

After stacking, the sub-assemblies are encased in a mold or envelope of standard size to form a *solid body*. Appropriate connectors are provided for plugging into another micro-

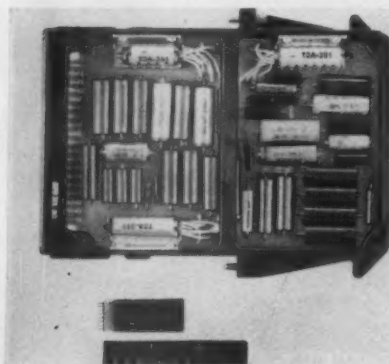
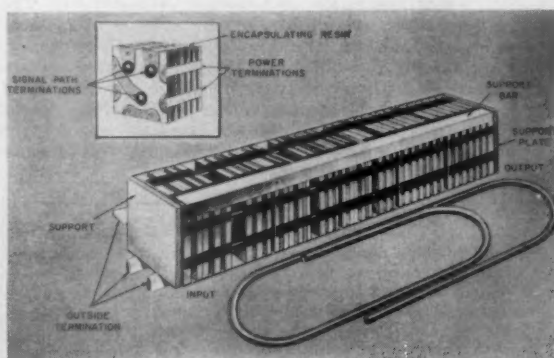


Fig. 2. Two versions of the same homing equipment. Larger unit uses present-day miniature production, while smaller device (above ruler) uses the micro-modules.

Fig. 3. Enlarged micro-module and multi-unit assembly of several micro-modules—compared to size of small paper clip.



module or a socket of another part of the complete equipment. In final form, a micro-module is three dimensional and approximately cubic in shape for most effective space utilization.

A greatly enlarged view of a typical micro-module is shown in Fig. 3, with identification of the signal circuit and power terminations. A number of different solid-state micro-modules may be connected together, by means of connecting bars and supporting braces, to achieve the desired circuitry. Note the size of the micro-module when compared to a small paper clip, both of which have been enlarged the same number of times in Fig. 3.

The mechanical structure of micro-modules makes them ideally suited for automatic manufacturing—automation—with completely controlled production processes. This will mean greater reliability at less cost than the conventional parts and components of today.

Use of micro-modules will mean greatly simplified servicing and maintenance. An entire module assembly, consisting of 30 to 40 electronic elements, can be replaced easily without the necessity for testing the individual elements of a stage or unit separately. If trouble develops, the entire module can be removed and replaced.

Applications

For a comparison of the functional and mechanical advantages of micro-modules, see Fig. 2 which represents the electronic homing assembly of one kind of Army missile. In the larger device, present-day miniature tubes, components, and transistors are used with economy of space, with bulk and weight held to an absolute minimum. But even this is no match for the assembly of micro-modules shown below it (and just above the ruler), which represents a reduction of more than ten to one in size, bulk, and weight. Through the use of the micro-module technique more than 50 separate electronic parts and components of the larger homing assembly are replaced by a single multi-unit micro-module.

High-thrust rockets and earth satellites also require elaborate electronic controls, data recording, storage, and transmitting equipment. Since bulk and weight are luxuries which cannot be indulged in rockets and satellites, the use of micro-modules is of extreme significance.

Some of the present-day components of a typical earth satellite are shown in Fig. 4. All parts are miniature, printed circuits abound, and every effort has been made to conserve space and weight. Yet when the identical circuit equivalent is in micro-modular form (Fig. 5) there is a reduction in weight and bulk to less than one-tenth of the original. Since satellite instrumentation requires a number of such electronic circuits—for surveillance, memory storage, telemetering, and other functions—the immediate application of micro-miniaturization could not be more appropriate than in

this field of inter-space exploration and operation.

In another operational instance, large commercial airliners presently require literally thousands of pounds of gear for communication, navigation, traffic control, and other electronic functions. As a typical example of only one type of radio navigation equipment for aircraft, there is the bulky apparatus shown in Fig. 6, and its electronic equivalent using micro-modules. With this kind of reduction in weight and size, considerable space can be released for profitable payloads—passengers or freight.

Future Program

If military requirements can be met through the present ambitious program of micro-miniaturization, later application to the commercial products of industry will follow easily since, in general, operational requirements for military electronic equipment are much more rigorous than for industry.

Army environment includes rough handling of equipment under extremes of temperature and humidity plus the heavy shock imparted when used in projectiles, rockets, missiles, and space satellites. Electronic equipment in Army missiles and projectiles must work through more than 10,000 g's and spins greater than 10,000 rpm. Equipment in earth satellites must operate in an almost-perfect vacuum.

After the value of micro-modular construction has been proven in military applications, commercial or industrial use will follow automatically. Such acceptance will progress more rapidly after the manufacturing concepts of automation have been perfected.

To achieve present military goals of micro-miniaturization, the combined military-industry program will take from four to five years at a minimum development cost of fifteen million dollars.

In addition to savings in space and weight, whole new concepts of manufacture and supply, repair and maintenance will develop with universal acceptance of micro-modular construction. There will be a substantial increase in the dependability of electronic equipment since automatic machine control of the micro-module production process will eliminate human error and reduce the quality variations which crop up on even the most efficient of present-day production lines. Automatic production will ultimately lower the cost price of micro-modular assemblies far below that of present-day single-function components used in electronic equipment.

Even though some electronic systems—such as automatic data gathering and processing equipment—become increasingly more complex, with the continued development of micro-modules, their repair and maintenance will become progressively simpler.

Micro-miniaturization—and its end product, the micro-module—is a revolutionary concept of vast proportions

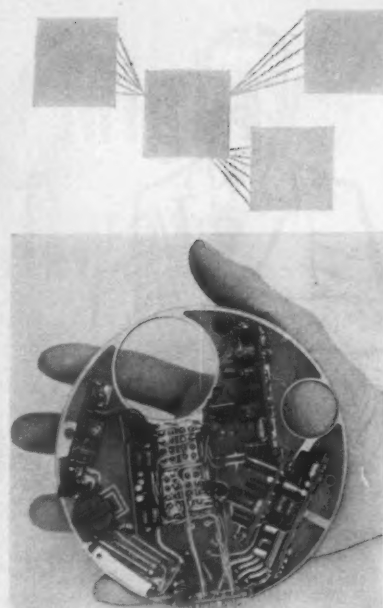


Fig. 4. Circuitry of earth satellite using conventional present-day components.

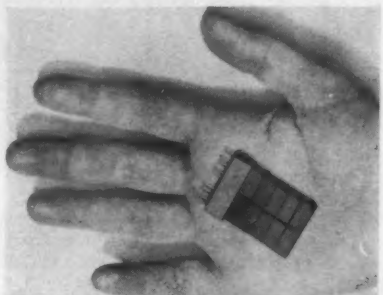


Fig. 5. Satellite circuitry using micro-modular construction. Compare with Fig. 4.

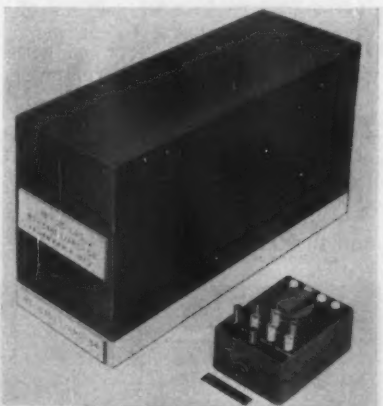


Fig. 6. Same radio navigating gear made with present and micro-modular techniques.

and major consequences. As development progresses, more and more electronic circuit designs will be approached from the standpoint of solid-state physics of basic materials.

Micro-miniaturization indeed heralds a new era of electronics and communication.



A New CRT Changes Philco TV Design

Another reduction in picture-tube depth plus a separate housing for this tube herald a new approach to set styling.

↑ Fig. 1. At the top is a conventional 110° CRT with yoke assembly. Below it is the "semi-flat" version of the tube.

← One 1959 Philco receiver permits separate location of the CRT, which connects to the chassis through a long cable.

MOST PICTURE-TUBE design engineers agree that a commercially feasible, truly flat CRT—one with no visibly protruding neck structure—is still years away. Nevertheless, the past two years have seen enough reduction in picture-tube depth to have a strong effect, if not on electrical design of the receiver, at least on cabinet styling and chassis layout.

To satisfy potential purchasers who want the shallowest possible sets, pic-

ture-tube depth, until now, has been reduced by progressively widening the deflection angle. However, the practical 110° system produces an impasse: further increases of the deflection angle, while attainable, could result in unrealistic receiver prices. To Philco engineers, therefore, the next logical step was reduction in the length of the protruding CRT neck. The successful result of their investigation is the 110° SF (semi-flat) picture tube, shown in

Fig. 1 directly under a conventional 110° CRT having the same screen area.

The reduction attained varies from one CRT size to another, but generally runs close to two inches. In part, this was achieved by bringing the electron-gun assembly in toward the bell of the tube, but the greatest factor has been a re-design of the gun assembly itself.

In conventional picture tubes, the cathode-heater portion of the gun involves a cylindrical structure. Philco engineers have abandoned this assembly, using instead a mica-supported box frame. As can be seen in Fig. 2, this makes the gun much shorter. At the top of the figure is the electron gun from a 90° tube. Immediately below it is the somewhat shorter gun assembly used for earlier 110° designs. Size and spacing of the electrodes show a reduction as compared to pre-110° CRT's. In the gun for the SF tube, shown at the bottom of the illustration, only the cathode-heater portion has been changed significantly as compared to preceding 110° types. Nevertheless, the space saving obtained with this measure is greater than that realized with the first step from 90° to 110°.

With the difference in gun size and positioning, the relationship between the deflection yoke and the beam it must influence also changes. Here we have another problem which is indicated to some extent by Fig. 1. In the lower part of the photograph, the base of the SF tube and a small portion of its neck barely protrude from the yoke assembly, and the yoke itself is in closer against the bell as compared with the yoke on the conventional 110° CRT at the top. With this changed relationship, yoke winding parameters

(Continued on page 90)

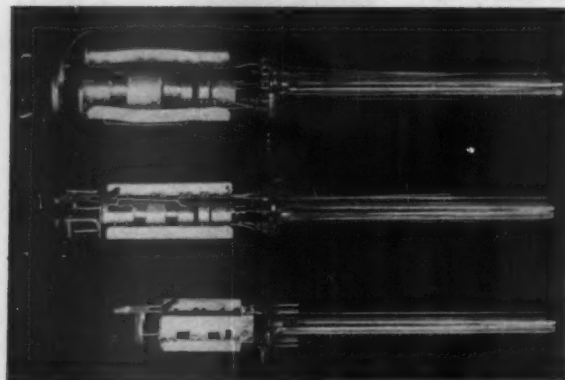
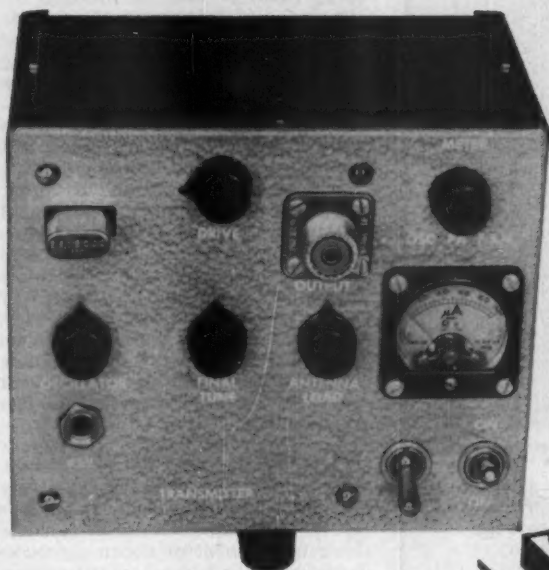


Fig. 2. The electron gun assembly at the top is from a 90° CRT. The one in the center is from a conventional 110° tube. At the bottom is the gun for the SF CRT.



The "Mighty Milliwatt"

Front view of little rig is shown. Unmarked switch will be used to change from c.w. to phone transmission. Pin jack for field-strength meter is brought out at the rear.

By DON STONER, W6TNS



A completely transistorized transmitter for c.w. operation on 10- and 11-meter bands.

THE ten-meter band conditions were very good on the 21st of March. I scanned the c.w. portion of the band intently and heard more signals than could possibly be worked that afternoon. Seems that a contest was going on. The key was ready to go and a crystal was selected for 28.15. I blasted out a "CQ," repeated it three times, and followed with my call three times. Finally, the transmission was ended with the familiar "K" and I reached expectantly for the receiver dial. On my frequency a loud signal was calling me: "W6TNS, W6TNS, W6TNS DE K9HEA, K9HEA, K9HEA, K." A broad smile spread from ear to ear as I gripped the key and proceeded to send a reply. This was my first contact with a brand-new rig.

Nothing unusual, you say? Happens every day? Well, almost, with one major exception—the transmitter is completely transistorized and was running 80 milliwatts (.08 watt) power input at the time! This should convince skeptics that it does not take high power to "get through," especially when Old Mother Nature has the ionosphere in good working condition. This was the first of many stations worked with the transistor transmitter.

K9HEA, whose handle is Jim, lives in Chicago. He reported that my transistor transmitter signals were readability 5 and strength 7, with some QSB (fading). Not bad for .00004 watt per mile! At this writing, the transmitter has only been in operation a few days, but contacts have been logged with W0KVY, Gene in Belton, Mo., who reported an RST of 569; K4EQM, Dee in Knoxville, Tenn., who gave the transmitter an RST of 549; and K4KWW, Horace of Chatham, Va., with an RST of 569.

Listening tests were arranged and reception reported by the following stations: K5KBH, Ken in Texas (RST

459); W0UAN, Bob in Minneapolis (RST 569); W5BYJ, Steve in West Memphis, Ark. (RST 559); and K9CRS, Ed in Zionsville, Ind. By 1800 PST, the band conditions had shifted to the Pacific. KH6BB listened for the "Mighty Milliwatt" and reported Q5 signals in Honolulu, T. H. At the same time, K9CRS was listening off the back of my beam and still heard the transmitter signals RST 438 (the weakest signal report ever given, incidentally).

I received an even greater thrill than contacting Hawaii when a tape recording of my signals, as received in Minneapolis, came in the mail from Bob, W0UAN. As a direct result of these contacts, your author has gone "DX mad" and is currently conducting tests with KX6BQ, on Perry Island in the Marshall group, in an attempt to break the existing distance record for a transistor transmitter.

Generally speaking, it is quite easy to obtain contact while using the "Mighty Milliwatt." The call "CQ-TR" ("I would like a contact. I am using a transistor transmitter") seldom fails to interest the curious. Pre-arranged schedules usually produce results. Most hams are very anxious to assist when testing low-power transmitters.

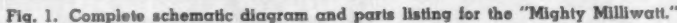
Circuit and Construction

The "Mighty Milliwatt" transmitter consists of a transistor oscillator stage, followed by a power amplifier (if I may call it that!). An RCA "drift" transistor, Type 2N371, is employed as a crystal oscillator in an overtone circuit. Although overtone crystals are slightly more expensive than a fundamental cut, the cost is more than offset by

the savings in components and reduced power consumption in this simplified circuit. To avoid confusion when ordering these units, the constructor should specify a third-overtone crystal. It might be a good idea to mention this particular circuit application as well.

The power amplifier consists of another RCA "drift" transistor, Type 2N370, operating class C. The efficiency of this stage is extremely high as evidenced by the brilliancy of the test lamp connected to the output. Amateurs who see this transmitter for the first time seldom fail to look for a direct connection between the batteries and the test lamp. No trickery is involved, however, as it is the r.f. power output from the transmitter power amplifier that lights the pilot lamp. The output tank circuit is link-coupled to the antenna. The pi-network configuration did not seem to work as well and the circuitry was more complicated. A variable capacitor is connected in series with the link to tune the reactance and to load the final amplifier. This capacitor works exactly opposite to the pi-network loading capacitor. As the capacity is increased, the loading increases. A drive control is employed in the oscillator circuit. This controls the vigor of the oscillator and, therefore, the power input to the amplifier stage.

The power source is ten medium-size flashlight cells connected in series to produce 15 volts for the collectors and for transistor bias. Current for both stages is metered by switching the miniature 0-100 μ a. meter to the proper circuit. Six-ohm shunt resistors convert the scale to 0-10 ma. in both current positions. The high meter sen-

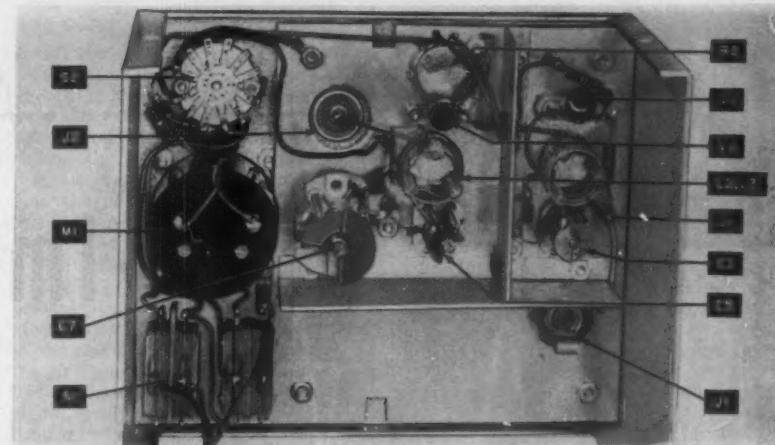


RADIO & TV NEWS

The power in milliwatts is equal to the collector voltage multiplied by the collector current in milliamperes. For example, if you load the final to 10 ma. (times 15 volts on the collector), it equals 150 milliwatts or .15 watt. I prefer to specify the power input in milliwatts for it sounds so much more impressive that way!

Those of you readers who are "hep" to transistor ratings have no doubt noticed that both transistors appear to be running out of rating for dissipation. The RCA data sheets for the 2N370 and 2N371 specify a dissipation of 80 mw. maximum at normal room temperature. The dissipation is derated to 20 mw. maximum at 71 degrees C. The published ratings, however, assume that the transistors will be used in class A service. Used in this manner, the transistor is biased for operation on the linear portion of the curve and it draws current all the time. In class C operation, the transistor is only conducting during a portion of the negative half cycle. Between each conduction period the transistor is "allowed to rest." Therefore, the transistor can handle more power input. In addition, using the transmitter on c.w. allows the transistors to rest between "dits and dahs." Unfortunately manufacturers do not publish ratings for class C ICAS (intermittent commercial amateur service). To determine safe ratings in conjunction with this transmitter, the author conducted a series of controlled destruction tests on the 2N370 and 2N371.

The transistors were operated in the transmitter on a continuous basis at 200 mw. input (20 volts @ 10 ma.). The 2N371 destroyed itself after 20 minutes while the 2N370 lasted about 35 minutes. The room temperature was about 28 degrees C. The 2N371 has a small amount of fixed bias to initiate oscillation and this, no doubt, caused it to burn out before the 2N370. I be-



Rear view. One-inch plastic squares between coils and chassis serve as insulators.

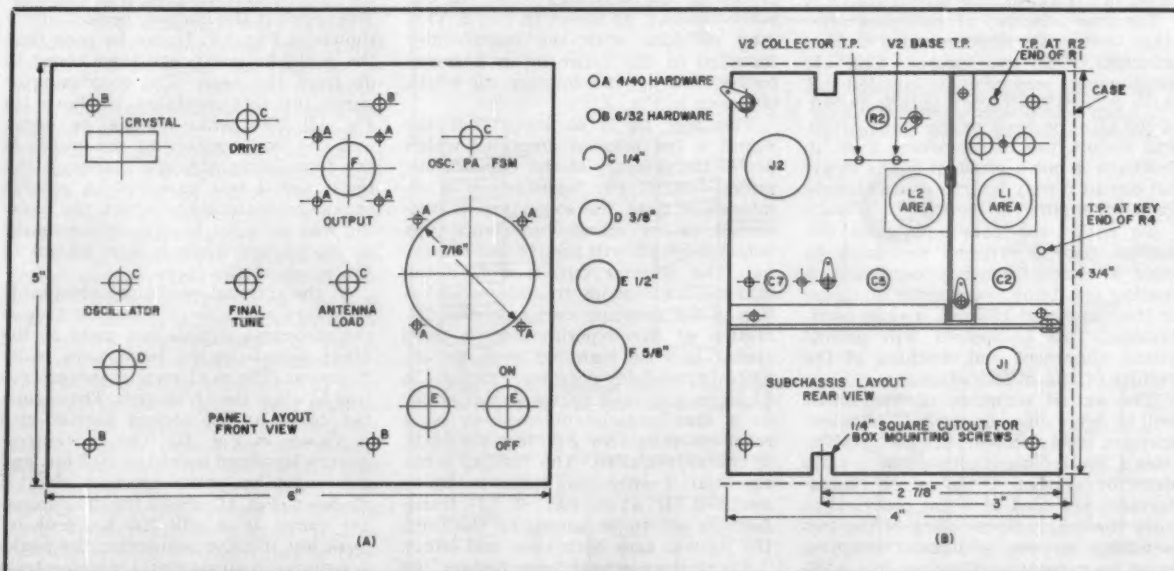
lieve that the transistors could be operated at this level on c.w., if the key were not held down too long. However, a more realistic input seems to be 150 mw. The transmitter will operate continuously at 150 mw. (15 volts @ 10 ma.) without damaging the transistors. As a further check, the collector voltage was reduced to 12 volts to produce 120 mw. input and the transmitter was run for a solid 24 hours. The semiconductors suffered no ill effects. Operated at 150 mw. input, no failures have occurred to date and none are expected. When "pushing" transistors to the limit one should remember that the room temperature is very important. Under no circumstances should the transistors be operated in excess of 20 volts on the collectors. Even with reduced collector current the transistors will go into thermal runaway. The transistor heats up, draws more current, gets hotter, draws still more current, until it destroys itself. A bypassed 180-ohm resistor in the emitter of the power

amplifier will retard thermal runaway.

I have found that any signals that register S9 plus 5 db (or more) on my "S" meter can be contacted with this transmitter. Of course, this "rule of thumb" is subject to one-way skip exceptions, etc. Generally, it holds true, though. This can be explained by the fact that the power of the "Mighty Milliwatt" is about 30 db below a typical 75 watt c.w. transmitter. Naturally, the whole thing is subject to the accuracy of your receiver's "S" meter.

I would also like to add a word of caution. You may operate this transmitter into a pilot lamp load without an amateur ticket. You *must*, however, have a General Class license to load an antenna and contact stations. Do not think that because of its small size and low power you are exempt or classified under the so-called "phono oscillator" regulations. This transmitter is fully capable of transmitting signals 5000 miles or more and *must* be operated under the rules and regulations of the FCC.

Fig. 2. Front view of the operating panel and rear view of the subchassis have been drawn here to scale.



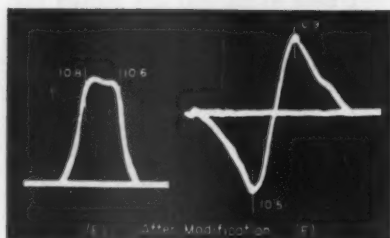
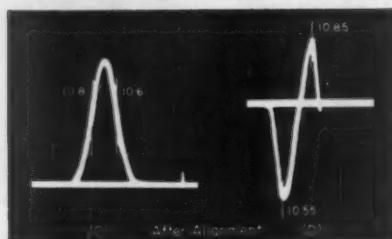
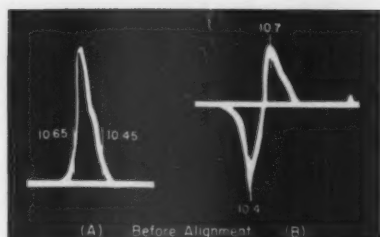


Fig. 1. The actual case record of one of the tuners modified by the author. Response curves (A), (C), and (E) were taken at the second limiter grid, while curves (B), (D), and (F) were at the discriminator.

THERE have been, and still are, some FM tuners, both kit type and factory assembled, which have insufficient i.f. bandwidth to give top fidelity reception of broadcast programs unless the received signal is an extremely strong one. It matters not what the sensitivity of the receiver is or how much AM rejection it has if it produces distortion on signals of reasonable strength.

The unsatisfactory i.f. bandpass situation that exists in some cases is due, principally, to two causes. The i.f. transformers may be under-coupled and there may be feedback from the output of the i.f. strip back to the input which will distort the i.f. response. Even if feedback is not a problem in the original circuit it may become one as transformer coupling is increased.

To make the tuner revisions described here it will be necessary to have a sweep-frequency oscillator, a marker oscillator to cover the i.f. range in the vicinity of 10.7 mc., and an oscilloscope. This equipment will permit visual alignment and checking of the results of the modification.

The actual sequence of operations will be determined by the type of transformers used and whether the receiver uses a limiter-discriminator or a ratio detector system. If $\frac{3}{4}$ " x $\frac{3}{4}$ " transformers are used, it is not practical to vary the magnetic coupling of the two windings so the additional coupling must be capacitive. Because this addi-

tional capacitive coupling will depend, to a great extent, on that already present, adjustments on this type transformer are most easily made when the transformers are checked in the tuner. In the case of some of the larger transformers which may be easily removed from their shields, the magnetic coupling is increased by moving one turn of one of the windings closer to the other winding, as shown in Fig. 3. This may be done with the transformer installed in the tuner or in a transformer test jig, the diagram for which is shown in Fig. 2.

This test jig is so wired that the signal is fed into an amplifier which drives the primary of the transformer under test. If the transformer is an interstage type, the secondary is connected to an infinite-impedance-type detector which will rectify the i.f. signal. The detector output is then fed into the oscilloscope to allow observation of the response curve. At the discretion of the experimenter, a third socket may be installed near the infinite-impedance detector socket. A 6AL5 may be used in this socket either as a discriminator detector or as a ratio detector. An FM test signal is, of course, required. The test jig is not essential if only one tuner is to be modified. If a number of i.f. transformers are to be wound or modified, the jig will save both time and effort.

Fig. 1 is an actual "case history" on

one of the tuners modified by the author. The tuner in this case was a kit which, according to the instruction booklet, was furnished with pre-aligned transformers which required no further adjustment to provide moderately satisfactory reception. The tuner was assembled according to instructions and, upon completion, the i.f. response to the second limiter grid was checked. The result is the narrow, peaked curve shown in Fig. 1A. It can be seen that the ± 100 kc. points are down about 15 db from the peak. The discriminator curve for this condition is shown in Fig. 1B. The peaks are 300 kc. apart and the line connecting the peaks is far from being straight although the input signal was sufficient to provide considerable limiting. In fact, the limiting was sufficient to obscure the marker pip except when it was moved to the peaks of the curve.

In the original condition, acceptable reception could be obtained on two of the strongest signals but most of the other signals in the band were badly distorted. The next step in the process was to align the i.f. system. The resulting curve at the second limiter grid is shown in Fig. 1C. The center frequency has been moved to 10.7 mc. and the ± 100 kc. points are now about 5 db down. Fig. 1D shows the discriminator curve. It is still 300 kc. peak-to-peak but the line connecting the peaks is now much straighter. Listening tests

Improving your FM Tuner

By **W. B. BERNARD**
Capt., USN

*Some changes that will take only a few hours to make
will pay large dividends in listening satisfaction.*

showed that additional stations could be received satisfactorily but that some of the stations which were limiting adequately were giving distorted reception when the modulation percentage was high.

It should be pointed out that the curves of Figs. 1C and 1D are not at all unusual with either kits or factory assembled tuners. The i.f. response can be broadened by stagger-tuning the transformer windings but this results in a reduction of gain in the i.f. system which, in many cases, is not acceptable. The preferable remedy is to increase the coupling between the primary and the secondary of the interstage transformers. In the case described, the transformers were of the $\frac{1}{2} \times \frac{1}{2}$ type so the additional coupling had to be capacitive.

The signal generators were connected to the grid of the first limiter and the oscilloscope was connected to the second limiter grid leak. The setup was then adjusted to give a good trace on the screen. A 2.5 μ fd. ceramic capacitor was connected from the first limiter plate to the second limiter grid. The transformer response increased to over 300 kc. at the 3 db points. This showed that 2.5 μ fd. was too much coupling and, having no smaller capacitors, it was necessary to use a "gimmick." A short length of wire was soldered to the grid terminal of the transformer and the other end brought near to the plate terminal. The response of the transformer narrowed considerably. This showed that this capacity was in opposition to the magnetic coupling; the 2.5 μ fd. unit had completely overcome the magnetic coupling and had over-coupled the windings as well. To get the magnetic and capacitive coupling to aid, it was necessary to reverse the connections on one of the transformer windings. In the tuner being modified it was simplest to cross the connecting wires going to the plate and screen of the tube driving the primary of the transformer.

Once the windings were correctly polarized, the gimmick was reconnected to the grid terminal. Hooking the insulated end over the plate terminal gave sufficient capacity to provide the desired bandwidth. The transformer was now over-coupled, that is, the response curve was double-humped with a deep valley in the center. The valley was removed by loading both windings with 39,000-ohm resistors.

Working toward the front of the receiver, the same treatment was applied to each of transformers. As the first transformer was adjusted the influence of feedback from the output of the i.f. system became troublesome. The trouble was temporarily eliminated by connecting the scope to the grid resistor of the first limiter and removing the second limiter tube from the socket. This permitted modification of the first transformer but, of course, some other remedy was needed before the system as a whole could be aligned. In this case the trouble was corrected by connecting a choke (consisting of 15 turns

of #20 insulated wire, wound on a $\frac{1}{4}$ " form) between the hot side of the heaters on the first limiter and the preceding tube and connecting a 5000 μ fd. disc ceramic capacitor from the hot heater terminal of the tube preceding the first limiter to ground. It may also be necessary to choke and bypass the plate supply leads and shield the bottom of the discriminator transformer and the discriminator socket.

The presence of this undesirable feedback is manifested by a wide variation in the response curve when the strength of the input signal is varied. When the signal is strong, the gain of the limiters is decreased and the feedback causes no trouble. When the input signal level is reduced, the gain of the limiters increases and the feedback also increases. When it is of considerable magnitude, it has a great effect on the response curve of the amplifier. It ordinarily results in a peak in the curve at low signal levels with the peak disappearing as the level is increased. The presence of this feedback can be checked by shorting out the primary of the discriminator transformer and noting whether the response, up to either of the limiter grids, is affected. If the curve is appreciably changed when the primary of the transformer is shorted, you have work to do.

After the feedback was reduced to a satisfactory level, the i.f. system was aligned. Fig. 1E shows the i.f. response of the modified tuner. At the second limiter grid the bandwidth is 200 kc.

with the ± 100 kc. points less than 2 db down. More important is the flat response across most of the 200 kc. bandpass. The discriminator curve, after modification of the rest of the i.f. transformers, showed that the discriminator transformer itself had sufficient bandwidth and thus needed no modification. Fig. 1F shows the discriminator curve of the modified tuner. The peaks are now separated 400 kc. and the line between them is straight. Listening tests showed that any station which gave limiting could be received satisfactorily.

The procedure for modifying a ratio-detector-type tuner with a limiter is the same as for the limiter-discriminator type. The modification of a ratio-detector type which has no limiter requires that some arrangement be made to check the response of the i.f. stages independent of the response of the ratio detector stage. In some cases it will be possible to get the signal for the scope from the screen of the driver tube. If, in the tuner you are checking, it is not possible to find any point which will provide a scope signal, it will be necessary to use a probe, similar to that shown in Fig. 4, to check out the i.f. system.

The changes described took only a few hours to make. This modest amount of work has paid big dividends in listening satisfaction. If you have or can borrow the necessary test equipment, you can make these same improvements in your tuner. -50-

Fig. 2. The schematic diagram shown here is of a circuit that may be employed for the testing of individual i.f. transformers as is described in text.

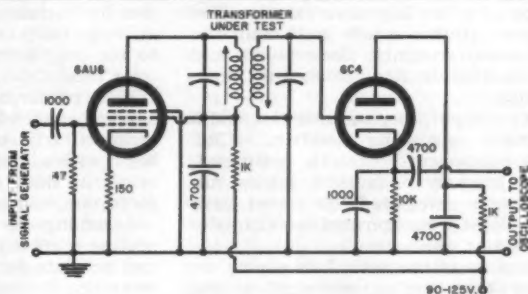


Fig. 5. Illustrations show a typical frequency-modulation intermediate frequency amplifier before and after changes.

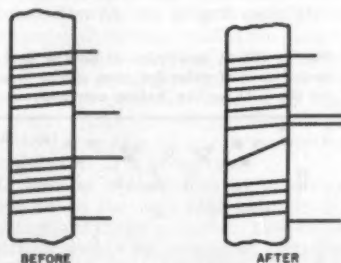
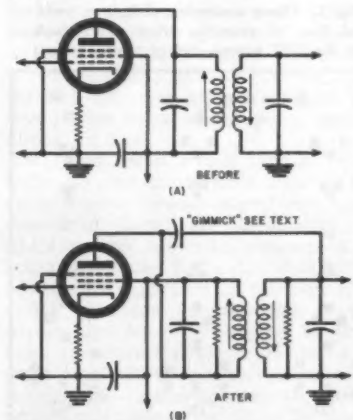
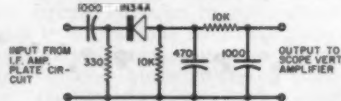


Fig. 3. I.f. windings before and after the coupling was increased. See text.

Fig. 4. Special oscilloscope probe for use where i.f. system has no limiters.



Convergence Time Savers

By **FRANK HADRICK**
Simpson Electric Company

*Preliminary appraisal of convergence cuts steps
because you know what to do before you start.*

THE MAJORITY of color TV receivers in the field today have separate dynamic convergence adjustments for controlling each of the three beams separately in the tri-gun color tube. In some instances, the service technician may spend considerable time performing these adjustments. This time can usually be reduced with greater recognition of a few key observations. The purpose of this article is to help the technician recognize these points and decide when he has achieved optimum results.

For our purpose, we have assumed a normally operating receiver, (CRT neck components correctly positioned, CRT properly degaussed, purity adjustments completed, etc.) and have only slightly exaggerated our examples for easier analysis.

Because of magnetic field effects, we know that purity, convergence, and grey-scale tracking adjustments must be performed on every color receiver in the location and position in which

it will be viewed. This means the technician must perform these adjustments in the customer's home. For obvious reasons, he is interested in doing a good job quickly and easily. However, to accomplish this goal, the following points may be helpful.

As we know, the purpose of the dynamic convergence voltages is to correct for increasing beam displacement as we go from the center of the screen to the top, bottom, and sides of the color tube.

Most color-receiver service manuals have recommended procedures for convergence adjustments which usually begin with a preliminary "minimizing" of all of the dynamic controls (zero correction voltage).

Assuming our color receiver is operating normally, as previously stated, and a white-dot generator is applied correctly, the technician performs the following steps:

1. "Minimize" all dynamic adjustments according to the manufacturer's

procedure. Horizontal phase adjustments should be correctly made.

2. Statically converge the three beams at the center of the screen.

At this stage, a vertical row of dot trios (through the center screen area) may appear similar to one of the three examples shown in Fig. 1.

The technician now observes this vertical row pattern, and notes the relative symmetry of the dot trios or lack of it.

If the dots appear as in Fig. 1A, he can assume that he has a good chance of attaining excellent vertical convergence with little difficulty and without completing all of the steps in the manufacturer's procedure. This is so because the appearance of the dots indicates that approximately equal amounts of parabolic correction voltages will be necessary for the beam from each gun to obtain *over-all equal vertical separation*. After this, the dots may then be statically converged to complete the vertical convergence. The technician will know the time required will be at a minimum; he can judge on the basis of his familiarity and experience.

If the dot trios appear as in Fig. 1B the technician can assume that final vertical convergence will be somewhat more difficult to obtain and will be more time consuming. Also, final vertical convergence will probably not be as good as what might have been achieved in Fig. 1A. This is so because, although the dot trios appear similar to example A, the red dots toward the bottom-right side are down slightly from those toward the top-right side. This condition could indicate that construction tolerances on that particular color tube (and/or associated components) are toward the opposite extremes. In this case, both parabolic and saw-tooth (tilt) voltages will have to be adjusted. With this knowledge, he can again judge the approximate length of time required for completing vertical convergence. However, excessive time should not be

(Continued on page 110)

Fig. 1. Three examples of how a vertical line of color-dot trios might look on the CRT screen before convergence.

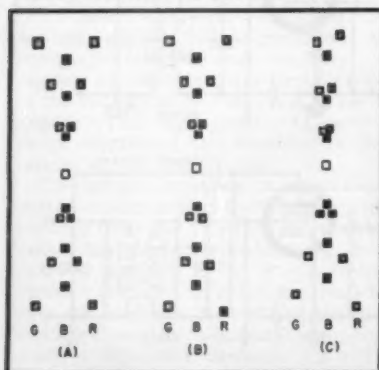
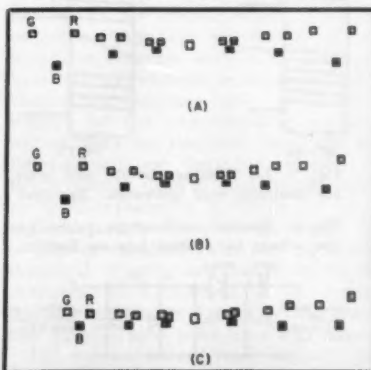


Fig. 2. Three examples of how a horizontal row of color-dot trios might look on the CRT screen before convergence.



Reducing Tape Recorder NOISE and HUM



Here is a very good summary of some of the main causes and cures of these tape recorder problems.

AT reasonable levels of reproduction, the electronic components in any high-fidelity system deserving of the name produce virtually no audible noise or hum. However, an important exception often occurs in the case of the home tape recorder. It can still be said of relatively few moderate-price tape machines that they exhibit low enough noise and hum levels to qualify as "high-fidelity" instruments.

This does not imply gross negligence on the part of tape machine manufacturers. Rather, it reflects the difficulties that must be coped with in tape playback. The signal produced by the playback head is seldom more than 5 millivolts, with 2 or 3 millivolts maximum being more usual. Compare this with the 20 or more millivolts obtained on peaks from the popular magnetic cartridges, and it is easy to see why tape amplifiers have a special problem. Furthermore, the signal produced by the tape playback head must undergo tremendous equalization, consisting of 36 db bass boost if the NARTB standard is followed. By comparison, the output of a magnetic cartridge undergoes only 20 db of bass boost. Substantial treble cut is applied to the signal from the magnetic cartridge—at the same time reducing noise—whereas the signal from the tape playback head undergoes no such de-emphasis and, in fact, may receive some treble boost instead to compensate for gap-width loss.

All-in-all, keeping noise and hum in a tape machine down to a level compatible with high-fidelity standards is no small feat. The following checklist seeks to remind or inform the technician or technically inclined audiophile of ways to combat noise and hum. Quite likely, a tape machine that at one time was sufficiently quiet is no longer. Or it may be possible to improve a machine that was always noisy. Or in constructing a tape amplifier it may be possible to guard against the many pitfalls that await the builder.

The measures to be described are not necessarily effective in all circumstances, but at one time or another they can prove worthwhile.

Reducing Noise

1. Tube Type: Tubes have been developed with special low-noise characteristics for critical applications. Such are the EF86, Z729, ECC83, 12AY7, 5879, etc. A low-noise tube can sometimes be directly substituted, without socket, wiring, or circuit value changes. Thus the ECC83 and 12AY7 can be used instead of the common 12AX7; these are twin triodes. Sometimes a new socket may be required as, for example, if one replaces a 6AU6 with an EF86 or Z729; these are pentodes. When replacing a 5879 with an EF86, the socket and circuit values are the same, but the connections to the socket must be rewired.

2. Tube Selection: Low-noise tubes command premium prices, yet this is not complete assurance that one is getting a satisfactory tube. Although the chances of getting a good tube are greater with premium than with conventional types, success can be assured only by being able to select the best of several units of a given type.

3. Resistor Noise: Resistor noise shows up in the very high gain circuit of a tape playback amplifier. Low-noise resistors should be used in at least the first stage and, preferably, in the first two stages. In subsequent stages, a conventional 2-watt resistor can be used for noise reduction. Low-noise types should be used not only in the plate circuit but also in the cathode circuit if the cathode resistor is unby-passed. Wirewound, non-inductive resistors are best, but most costly; moreover, the resistor does have some

residual inductance and is therefore susceptible to hum pickup. Deposited metal film resistors can be virtually as noise-free as the wirewounds. One should be wary of the deposited carbon resistor in this application. Although some deposited carbons have excellent noise properties, others are little better than ordinary resistors.

4. Tape Hiss: The substantial treble boost in playback, employed by a number of tape machines, accentuates tape hiss caused by imperfect cancellation of the minute magnetic fields on the tape, called "domains." A tape machine conforming to NARTB equalization principles applies all or most of the necessary treble boost during recording instead. To change a tape amplifier to NARTB equalization in both recording and playback modes is fairly major surgery. Tape hiss can perhaps be kept down by subjecting the tape to a bulk eraser instead of always relying on the erase head. Tape hiss may be accentuated by significant departures from flat treble response in the control amplifier, power amplifier, or speaker. The speaker is the most likely culprit. In the case of commercially recorded tapes, substantial hiss may be recorded on the tape as the result of too many "generations" of tape.

5. Head Noise: Heads tend to gradually become magnetized due to the asymmetrical audio waveforms presented to them; the asymmetry, in effect, constitutes a d.c. component. A magnetized head has a d.c. field which records a d.c. pattern on the tape that varies with the irregularities in the coating and base of the tape. In playback, these irregularities are heard as noise (modulation noise), therefore it is advisable to demagnetize the heads periodically, say after 10 to 20 hours

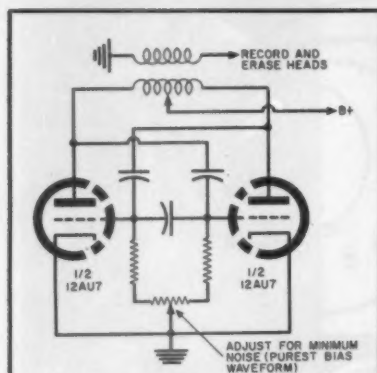


Fig. 1. Push-pull bias oscillator.

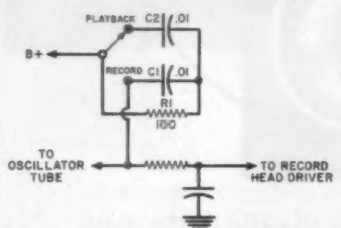
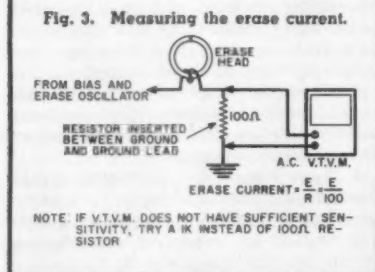


Fig. 2. Method of preventing surges.



of use, with an electromagnet designed for this purpose. Heads may also be magnetized by accidental contact with a magnetized tool, such as a screwdriver, or by d.c. current flowing through them because of a leaky coupling capacitor.

6. Bias Waveform: The waveform produced by the bias oscillator and fed to the record and erase heads should be as close as possible to a pure sine wave. Distortion in the waveform can be a source of noise because such distortion may represent a d.c. component, magnetizing the head and causing noise, as already explained. The bias waveform should be viewed with a scope to pinpoint gross distortion, if present. But this is only a preliminary check, because much less than the approximately 5% distortion discernible on a scope can produce appreciable noise, therefore voltages and components in the oscillator circuit should be checked. Possibly the oscillator is overloaded by a defective erase head or other defective component. High quality recorders generally employ a push-pull oscillator, typically a 12AU7 or 12BH7, and in the case of poor waveform the circuit should be checked for matched com-

ponents, namely grid resistors and coupling capacitors. Fig. 1 shows a typical push-pull oscillator circuit. This one also incorporates a means of balancing each half of the oscillator for maximum symmetry and, therefore, purest waveform; that is, the grids are connected to ground through a balancing potentiometer.

7. Tube Voltages: At times tube noise can be significantly lowered by operating the heater at moderately reduced voltage (through a series resistor), for example, about 5.5 volts in the case of a 6.3-volt tube. Noise also tends to vary inversely with plate current so that a higher "B+" voltage supply or smaller plate resistor can reduce noise. (But in the case of triodes, reducing the value of the plate resistor may raise distortion; in the case of pentodes, it will significantly reduce gain.)

8. Shock-Mounting: Even the best of tubes are somewhat susceptible to microphonics, set up by vibration of the transport mechanism. Shock mounting is therefore advisable for the first tube and possibly for others as well. The socket may be spaced away from the chassis by using rubber grommets on the socket-mounting screws.

9. Switching Transients: Clicks may be recorded on the tape when motors, relays, etc. are switched on or off. This can be prevented by placing capacitors—suitable values are about .01 to .05 μ fd.—across the switches and relay contacts.

10. Current Surges: Sudden application or removal of "B+" from the oscillator and record-head driver stages, which is apt to occur when switching between record and playback, may cause clicks and pops to be recorded. Also, these current surges may cause the heads to become magnetized, producing noise as previously explained. Again, capacitors can solve the problem. Fig. 2 is a typical circuit, incorporating capacitors C_1 and C_2 in series with a resistor R_1 , so that "B+" will be gradually applied or removed from the record-head driver and oscillator.

11. Imperfect Erasure: If the tape has previously been recorded and is imperfectly erased when next used for recording, some of the previous program material will be audible, often annoyingly so. The fault may lie in an erase head of poor design or one with shorted turns. Insufficient erase current may be reaching the erase head. This can be checked as shown in Fig. 3, where current is determined by Ohm's Law by reading voltage across a resistor, namely $I = E/R$. The amount of current should be that specified by the manufacturer, with 10 to 20 ma. a typical value for erase heads in most home tape machines. If erase current is too low, then the oscillator circuit and the components coupling it to the erase and record heads must be checked. Even though erase current is of the value suggested by the manufacturer, the erase head may be ineffective because the current frequency is too high, so that the winding capacitance of the head acts as a substantial short-circuit.

Thus for a given amount of erase current, an erase head may erase well at 65 kc. and poorly at 100 kc. When a tape has been recorded at an excessively high level, even a normally operating erase head may be unable to achieve adequate erasure. An electro-magnetic bulk eraser is then required, provided one is willing to erase the entire tape and not merely one track. If one track must be kept, the only recourse is to put the tape through the record process, with the volume control all the way down, thereby subjecting one track to a preliminary erasure. Of course this is very time-consuming.

12. Print-Through: Also known as pre-echo and post-echo, this refers to the appearance (on a given portion of the tape) of the signal on adjacent layers of tape. Print-through is apt to become audible if the tape has been recorded at high level; also if the tape is stored in a warm place and/or near magnetic fields. For a given set of circumstances, print-through is greater for the thinner tapes.

13. Record Level: Excessive noise may simply be due to a low recording level. This can be checked by comparing the level of a tape recorded on one's own machine with a commercially recorded tape that sounds clean (some recorded tapes have obvious distortion due to over-recording). Inadequate record level may be due to malfunction of the record level circuit, which should be checked. For example, the signal may be fed to the record level indicator through a voltage divider and one of the resistors in the voltage divider may be of incorrect value, causing the indicator to read higher than it should, resulting in too low a recording level being set. A low recording level may be due to a fault in a stage following the point at which the signal is fed to the record level indicator. Thus the record-head driver tube may be weak, the record head may have developed shorted turns, insufficient bias current may be reaching the record head, etc. Conventional troubleshooting procedures are indicated here, including voltage and resistance checks.

14. Gain Control: If the gain control is located in an early stage in the playback circuit, turning down the control will fail to simultaneously reduce the noise of the later stages. It may be advisable to install a dual gain control with one section in a later stage. For best results, the tape machine should be operated in the playback mode with gain full on (provided this does not overload the tape amplifier, as happens in some machines) and then the signal should be reduced by the input level-set or volume control of the following equipment, which will typically be a control amplifier; at the same time, noise in all stages of the tape amplifier will be reduced.

Reducing Hum

1. Tube Type and Selection: As with noise, use of a preferred type of tube and selection of the best tube out of several of the same kind can lead to

a rather substantial amount of hum reduction.

2. Tube Shield: Tube shields should be employed for at least the first stage and preferably the first two. As an extra precaution, the shields should be demagnetized by means of the bulk eraser used for erasing tapes. Extra shielding can be provided for the tube by wrapping it in a layer of "Co-Netic" (Perfection Mica Co.), an effective, but expensive, shielding material.

3. Tube Demagnetization: Sometimes hum can be reduced by demagnetizing the input tube (and others as well), using the bulk eraser. Since the eraser is usually very powerful, caution should be exercised so that the tube is not brought near enough to the electromagnet to dislocate the tube elements themselves.

4. Hum-Bucking Pot: One of the simplest, least expensive, and most effective means of reducing hum is to use a hum-bucking pot in the heater supply, as shown in Fig. 4A. In a number of inexpensive tape machines, a.c. is employed on the heaters, with the electrical center of the transformer's heater winding connected to ground. However, electrical center is not necessarily the best grounding point for maximum hum reduction. It is the authors' experience that with use of a hum-bucking pot, a well-designed tube (such as an EF86 or ECC83) and normal care in dress of heater, grid, and plate leads, hum can be brought to a level almost as low as that obtained with a d.c. heater supply.

5. Biasing the Hum-Bucking Pot: Sometimes the effectiveness of the hum-bucking pot can be increased by connecting the arm to about 20-50 volts "B+," as shown in Fig. 4B, instead of to ground. A large capacitor, of about 20 to 40 μ f., should be employed for a.c. grounding. By making the heater positive with respect to cathode, this prevents a.c. current flow from heater to cathode due to emission of electrons by the heater.

6. D.C. Heater Supply: A d.c. heater supply can make the choice of an input tube and the problems of lead dress less critical. Fig. 5 shows a circuit for converting an a.c. 6.3-volt heater supply into a d.c. supply for either 6- or 12-volt tubes.

7. Rectifier Tube Hum: The rectifier tube develops a magnetic field which may extend far enough to cause hum pickup by another component. Thus it would be poor practice to put the rectifier and input tubes next to each other on the chassis. Shielding the rectifier tube as well as the other tube may help, but in the case of the rectifier tube the containment of heat will appreciably shorten its life.

8. Head Shield: A major source of hum pickup is the playback head. Professional tape machines usually surround the heads with a heavy shield during operation, leaving a gap just wide enough for the tape to pass through. Home recorders ordinarily employ less expensive and generally less effective head-shielding measures.

Sometimes hum can be reduced by placing a small piece of shielding material, such as "Mumetal," "Co-Netic," or a piece of silicon steel from a junked power transformer, in front of the head gap. Thus if the machine uses pressure pads, as most inexpensive ones do, it may be possible to glue the small shield to the bracket holding the pressure pads.

9. Input Grid Shield: Significant hum reduction, especially if a.c. is used on the heaters, is possible if the grid of the input tube is shielded, as shown in Fig. 6. The shield can be formed from a piece of tin can, soldered to the center pin of the tube socket.

10. Input Lead: The lead from the playback head to the input of the first playback tube is apt to be relatively long and thus susceptible to hum pickup. It is advisable that this lead be shielded, but using low capacitance coaxial cable to minimize high-frequency losses. Wrapping a material, such as "Co-Netic," around the lead may give the additional protection that is required.

11. Lead Dress: Grid and plate leads must be carefully routed away from hum sources, such as heater leads, power leads, power transformers, etc. It is advisable to dress the grid and plate leads as well as associated components, namely resistors and capacitors, close to the chassis, which acts as a shield. Lines carrying a.c. which run more than an inch should be twisted so that the magnetic field of one wire cancels that of the other. These a.c. lines should be routed within the 90° corner formed by two walls of the chassis if at all possible.

12. Chassis Ground: The chassis should not be employed as a ground return because magnetically induced hum currents circulating through the chassis may be coupled to low-level audio signals. Instead, one common ground point, well-soldered to the chassis near the grid of the first playback tube, should be used. Use of a bus-bar is considered good practice or one may use several tie lugs as secondary grounds, each wired to the principal ground point.

13. Ground Loop: An inadvertent ground loop, that is, a multiple path to ground, may cause substantial hum. For example, if the ground lead of the playback head is returned to ground through the shield of a coaxial cable, if this shielded wire accidentally contacts the chassis, and if the chassis is separately grounded, then there are two paths to ground for the head. The resultant loop is, in effect, an inductance that can pick up hum.

14. Location of Power Transformer: The power transformer should be mounted as far as possible from the playback head. Often it is put on a separate chassis, along with the rectifier tube and associated power supply components. Removing just the transformer from the tape amplifier and mounting it elsewhere, either inside or outside the common housing for the transport and amplifier by means of ex-

tended leads, can appreciably reduce hum.

15. Mounting the Power Transformer: In building a tape amplifier, it is preferable to use a transformer that mounts above chassis rather than flush with it (part above and part below), because in the case of flush mounting the chassis acts to extend the transformer's magnetic field.

16. Orientation of Transformer and Motors: Hum may be alleviated by rotating the transformer and/or motors, as mounting conditions permit. For example, turning the transformer 90° or a motor 120°, if possible, may prove a worthwhile effort, causing the magnetic field to change direction and thereby produce less hum pickup by a component that cannot be moved, particularly the playback head.

17. Shielding the Transformer and Motors: Well-shielded motors and transformers are considerably more expensive than the garden variety and thus not too likely to be found in moderate-priced tape machines. Yet the power transformer and the transport mecha-

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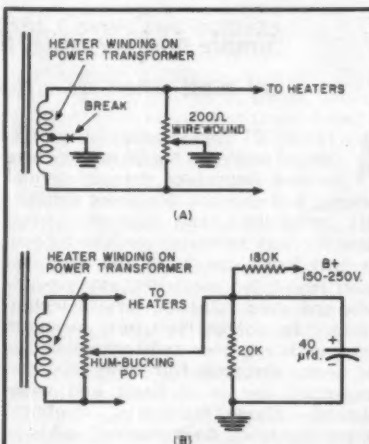


Fig. 4. Installing a hum-bucking pot.

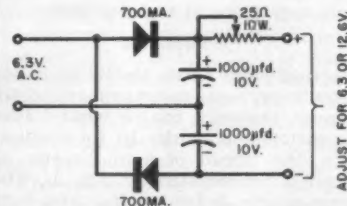
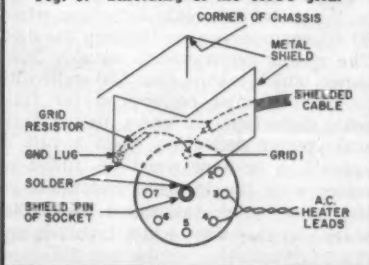


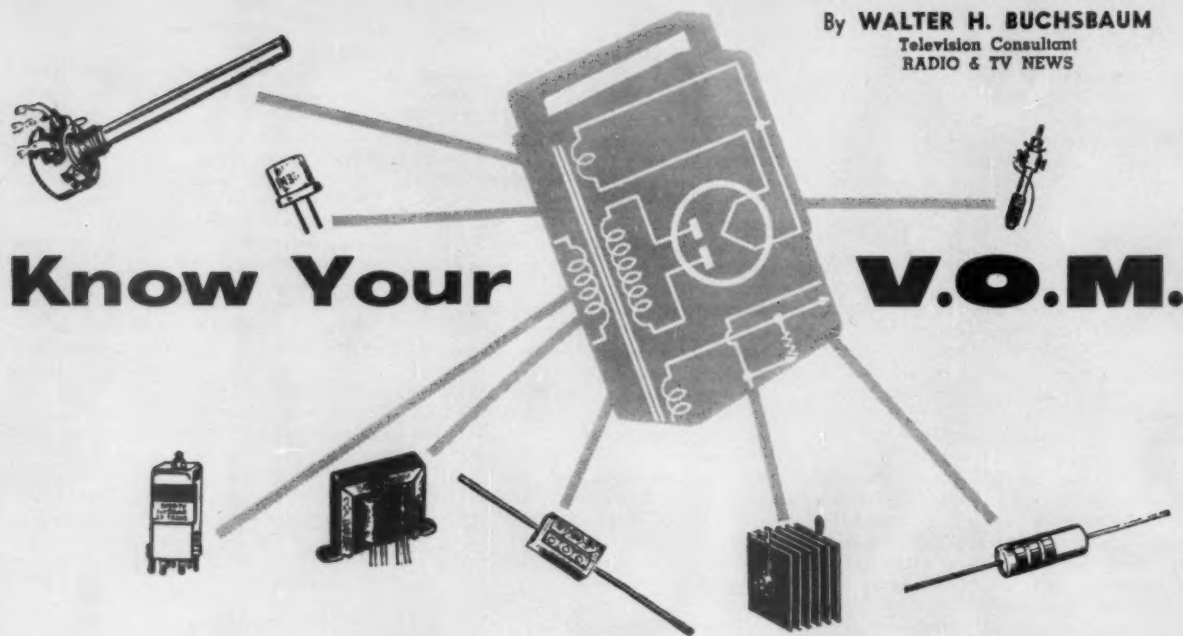
Fig. 5. Rectifiers are rated at 18 v. (Use Federal's type 1013 or equiv.)

Fig. 6. Shielding of the 6AU6 grid.



Know Your

V.O.M.



Simple and versatile, this basic instrument pays off most when its virtues and limits are known.

ALTHOUGH the vacuum-tube voltmeter and the oscilloscope have become important measuring and testing instruments, for sheer simplicity, versatility, and over-all usefulness the volt-ohmmeter can't be topped. It still forms the basic and first test instrument for amateurs, experimenters, and even full-time service technicians. In many electronic research labs, each engineer and technician has a v.o.m. assigned full time, just because its use is so basic and widespread. Many students, electrical experimenters, do-it-yourself addicts, and persons only loosely associated with electronics own a v.o.m., often as their only piece of test equipment.

Performance

Actually the v.o.m. should be called a multi-purpose microampere meter because, basically, that is what makes the instrument work. In its simplest form, the circuit of a multimeter or v.o.m. is represented by Fig. 1. The meter-needle deflection indicates current through the meter coil and the resistor in series with the coil represents the resistance of the coil itself.

In most of the sensitive v.o.m.'s, the meter shows full-scale deflection when 50 microamperes pass through the coil. The meter resistance is usually 2000 ohms, which means that 100 millivolts or .1 volt must be applied for full-scale deflection. In order to get full-scale meter deflection when 1 volt is applied, a resistor must be added in series with the internal resistance so that the total resistance is 20,000 ohms. In this way, when 1 volt is applied across the series combination,

1/10 of the total, or .1 volt actually appears across the meter, which then reads full-scale. It is from this fact that the sensitivity rating of "20,000 ohms-per-volt" is derived for meters of this type.

Concerning this sensitivity rating, considerable confusion exists in the minds of many people. Let us say that the user of a v.o.m. is preparing to measure a voltage which he expects to be about 4 or 5 volts. The most suitable range on his instrument for this measurement is the 10-volt scale. When he switches to this range, he puts enough resistance in series with the basic meter so that the combination comes to 200,000 ohms ($10 \times 20,000$). As long as he is using this range,

200,000 ohms is the input resistance of the meter, irrespective of the voltage (up to 10 volts) being measured.

When the v.o.m. user is operating on the 100-volt range (or higher), input resistance of the instrument will be 2 megohms (or higher). Thus the meter is not likely to load circuits under test to a significant degree most of the time. However, in dealing with such high-impedance circuits as vacuum-tube grid configurations and a.g.c. lines, the loading problem does arise.

A typical case is illustrated in Fig. 2. Here the grid bias, 5 volts, is due to grid-leak detection across a 500,000-ohm resistor. Such a circuit is typical of audio limiters in FM and TV sets. When the v.o.m. is connected across the grid resistor and set to the 10-volt scale, it would represent a shunt resistance of 200,000 ohms ($10 \times 20,000$ ohms). This would reduce the effective value of grid resistance to about 140,000 ohms and the grid bias developed would now be reduced considerably. The v.o.m. will indicate the existing bias, which will be substantially less than the 5 volts present without the shunting effect. A reading taken in this way can be misleading or even useless. In measuring grid bias voltages with any degree of accuracy, the vacuum-tube voltmeter should be used because it has a very high input resistance, usually about 10 megohms, irrespective of range setting.

Accuracy

Accuracy of most of the v.o.m.'s now on the market is on the order of 3% for d.c. and 5% for a.c., based on full-scale. This is another specification that is not often understood. If a meter is rated at 3% accuracy for d.c., then it may be 3 volts off on the 100-volt scale—but this 3-volt error may

(Continued on page 103)

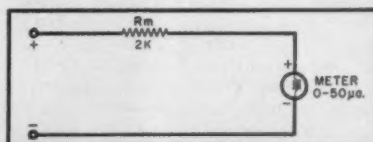


Fig. 1. Basic circuit diagram of v.o.m.

Fig. 2. Loading effect when low-voltage scale is used across high impedance.

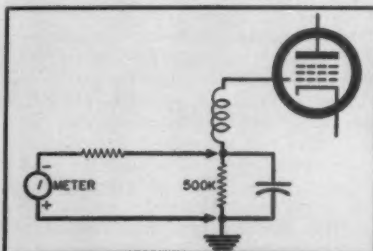




Fig. 1. Lower row of push-buttons of "Electro-Melodeon" are "white" keys, upper "black" keys.



The "Electro-Melodeon"

By HARTLAND B. SMITH, W8VVD

Small electronic organ fills the gap between toy organs and full-size consoles. Has a built-in vibrato and number of stops. Covers two octaves.

BACK in the days when vaudeville and night club acts were making the rounds of the TV variety shows, there was a talented monkey which appeared on a number of programs. This little fellow would sit down in front of a box-like electrical device and, by pressing a few buttons, would proceed to make something that sounded remarkably like music. While his technique wasn't the best, the sounds which came from his instrument rivalled those produced by a commercially built electronic organ.

This "monkey music box" intrigued me. I had been looking for a simple instrument that would suit my meager talents and here was one that even a monkey could play! Furthermore, it had a truly superb tone quality.

I thumbed through my collection of technical magazines in search of an article which might tell about a similar musical device. I found a number of simple gadgets described, but these were hardly more than toys. At the opposite extreme were the full-sized electronic organs which were interesting to read about, but which would obviously take many hundreds of hours to construct. Even after I had spent all that building time, I'd end up with an instrument that would be way beyond my musical abilities. Finally I decided to give up my search and wait until something better adapted to my needs came along. However, since nothing of this type ever seemed to appear in the "do-it-yourself" magazines, I finally had to break down and design my own instrument.

After quite a bit of reading, cogitating, and experimenting, the "Electro-Melodeon" was born. Although it contains only four tubes in a relatively simple circuit, it is capable of producing sounds which closely resemble those of a commercially built electronic organ. Its 25 notes cover two octaves, a range

sufficient to take care of almost all familiar compositions. It has five different stops which give it a number of "voices" including those with reed, horn, and string-like qualities. A solo instrument, it can be easily played by anyone who is familiar with the treble scale.

As shown in the schematic of Fig. 5, V_{2A} acts as a Colpitts oscillator, the frequency of which is determined by the values of C_2 in Fig. 4 and C_3 and CH_2 of Fig. 5. The sine-wave output of the oscillator is taken from the plate of V_{2A} and is fed to the grid of V_{3B} , the first audio amplifier stage, via C_5 , R_6 , and R_7 .

An undistorted note, by itself, is rather monotonous and has almost no musical value. Harmonics of the fundamental frequency are required to provide the necessary timbre that makes a note sound melodious to the ear. The audio voltage appearing across R_{11} is rich in harmonics. These harmonics are picked off the cathode of V_{2A} and, after passing through the stop switch S_2 and its associated filter assembly, they are fed to the grid of V_{3B} .

Although a violin, flute, trumpet, and clarinet are capable of producing the same note on the musical scale, each instrument gives its own distinctive quality to that note. This effect is the result of the individual instrument's ability to mechanically suppress or increase certain harmonics of the fundamental note being played. Electronic organs attempt to imitate various musical instruments by employing a number of electrical components to either reduce or accentuate the harmonics. In the "Electro-Melodeon," the wiring associated with S_2 makes possible five different configurations of CH_1 , C_6 , and C_{11} . Positions 1 and 2 im-

part a reedy quality to the music. Position 3 has a peaked response similar to that of a horn. Positions 4 and 5 result in tones similar to those produced by stringed instruments.

The "Voice" potentiometer, R_{11} , is used to control the amount of filtered harmonics reaching the grid of V_{3B} . By varying the settings of the "Fundamental" control, R_8 , and the "Voice" control, while utilizing different positions of the "Stop" switch, S_2 , an almost infinite variety of tonal qualities can be synthesized.

Probably the greatest difference between the technique of the beginning violinist and that of the accomplished virtuoso, is the pleasing vibrato which the latter superimposes on the music coming from his instrument. This vibrato is also a distinctive feature of what may be termed "electronic organ quality." V_1 acts as a 5-cycle vibrato oscillator. The output from this oscillator is coupled, by means of R_9 , to the grid of V_{2A} where a slight frequency modulation of the note being played takes place.

The amount of vibrato applied to the oscillator depends on the value of R_9 . The higher this resistance is, the less noticeable the effect will be. Since I prefer quite a bit of vibrato, I settled on 2.2 megohms. If you wish to reduce the frequency modulation to some extent, you can substitute a 4.7- or 10-megohm resistor at this point.

A 6AR5 was chosen for the output stage because this tube will supply a respectable signal without drawing an excessive amount of either heater or plate power. Because of the tube's modest requirements, an inexpensive low-current transformer may be employed for T_1 . A 4-inch speaker is mounted behind 25 $\frac{3}{16}$ " holes drilled in

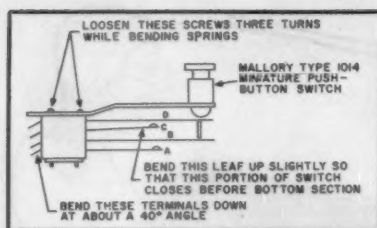


Fig. 2. Modifications required to adapt d.p.s.t. push-button switches for use.

the top of the chassis. This arrangement amply protects the speaker cone from damage, while allowing plenty of sound to pass through the holes. If you desire better reproduction than can be had from a small speaker, a 12- or 15-inch unit may be connected to J_1 . Should you want more volume, as well as improved tone, a shielded lead may be run from J_1 to the low-gain input stage of your hi-fi system.

There is one feature of the "Electro-Melodeon" which will be especially appreciated by the non-musical members of the family. During practice sessions, a pair of headphones plugged into J_1 will silence the speaker. Then, only the individual playing the instrument can hear the result of his efforts.

The keyboard consists of 25 d.p.s.t. switches mounted on the sloping panel of an ICA Type 3370 10" x 17" chassis. As can be seen in Fig. 1, a 3" x 16" piece of aluminum behind the switch mounting nuts has been used to dress up the keyboard a bit. This piece of aluminum, as well as the music rack, was sprayed with metallic copper paint. After applying this paint, the kind that comes in a pressurized spray can, be sure to add a protective coat of clear lacquer. If this is not done the finish will soon become permanently marked with fingerprints which apparently corrode the copper particles in the paint.

A number of different keying systems were tried, but the one finally chosen has proven to be the most satisfactory. I had hoped that s.p.s.t. switches could be used to connect the various frequency-determining capacitors, C_n , into the circuit. Although this

system gave the desired changes in pitch, it created a very annoying click whenever a key was depressed or released. This click was the result of the charging and discharging currents which occurred when one of the C_n capacitors was connected to or disconnected from the circuit. The click problem was overcome by using d.p.s.t. switches to key the plate voltage of V_{2B} an instant after switching in a C_n capacitor. Mallory Type 1014 miniature push-button switches are used for the job. Before mounting these switches on the sloping panel, they must be modified slightly, as shown in Fig. 2. Wiring will be simplified later on if you bend terminals A, B, C, and D down at about a 40° angle. Since the top section of the switch is used to key the C_n capacitors, this part must close a fraction of a second before "B+" is applied to V_{2B} through the bottom set of switch contacts. In order to accomplish this action, the C spring of the top section is bent up slightly. This can be most easily done if the two screws which hold the switch together are temporarily loosened three full turns. After bending the C spring with a pair of long-nosed pliers, these screws must, of course, be securely retightened. When properly adjusted, the gap between the C and D springs of the switch will be narrower than that between the A and B springs. Be careful, though, not to bend spring C so much that it touches D when the push-button is not depressed.

The small, but important, keying delay which results from the modification just described, allows the appropriate tuning capacitor to be connected to the oscillator before plate voltage is applied to V_{2B} . Since V_{2B} cannot provide audio output with no "B" voltage, the clicks which accompany the switching of the C_n capacitors do not reach the speaker. R_{2B} , C_{1B} , and R_{1B} filter out any click which may result from keying the "B+."

Pieces of No. 14 or No. 16 bare copper wire about 1½" long should be soldered to the ground lugs of all but seven of the switches. These wires will help to support the C_n and C_p capacitors which will later be connected between the switches and ground. Since the ca-

pacitors of the seven lowest notes do not go directly to ground, the heavy wires may be omitted from these switches.

V_1 , V_2 , and V_3 , together with their associated parts, are mounted on a 3" x 4½" piece of aluminum. Most of the wiring of this sub-chassis can be done before it is fastened to the main chassis. This procedure will greatly simplify the construction process, eliminating the need to solder in a confined space.

The 5Y3GT socket is mounted by means of a small L-shaped bracket fashioned from a piece of scrap aluminum. The power transformer is also held in place by similar brackets. To insure adequate ventilation, no bottom plate is used on the chassis. Rubber feet should be fastened to the lip around the under side of the instrument to act as a protection for any piece of furniture on which the unit may be placed.

A music rack can be fashioned from a 12" x 16" piece of sheet aluminum, as shown in Fig. 3. The bottom 2 inches are bent at a right angle to form a shelf. A strip of aluminum 2" x 10" is fastened to the back of the rack with 6-32 machine screws. The lower 3 inches of this strip are allowed to extend beyond the bottom of the rack to form a tongue. A 3¼" x 4" plate is fastened to the back of the chassis. Flat washers are used to space this plate away from the chassis by an amount slightly greater than the thickness of the aluminum. The tongue can then be slipped between the plate and the chassis to support the rack. This arrangement makes it possible to remove the rack for ease of handling and storage.

Close scrutiny of Fig. 6 will reveal that no shielded wiring is employed in the "Electro-Melodeon." Despite this fact, no objectionable hum can be detected in the speaker. This happy situation is the result of having the plate voltage of V_{2B} cut off except when a strong signal is fed to it by the oscillator. Only V_2 is operative without a signal and the grid of this low-gain stage is relatively insensitive to stray hum fields.

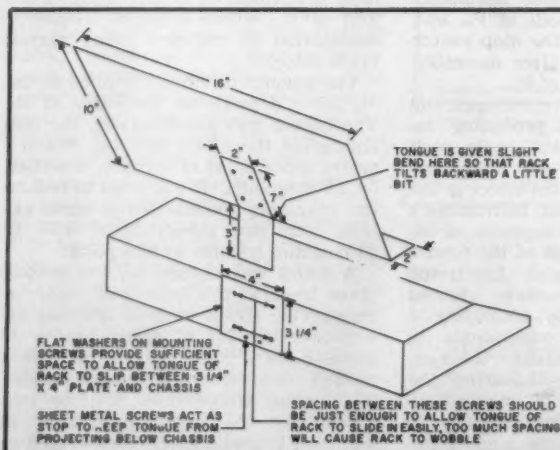
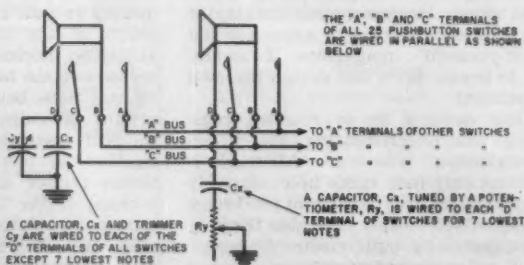
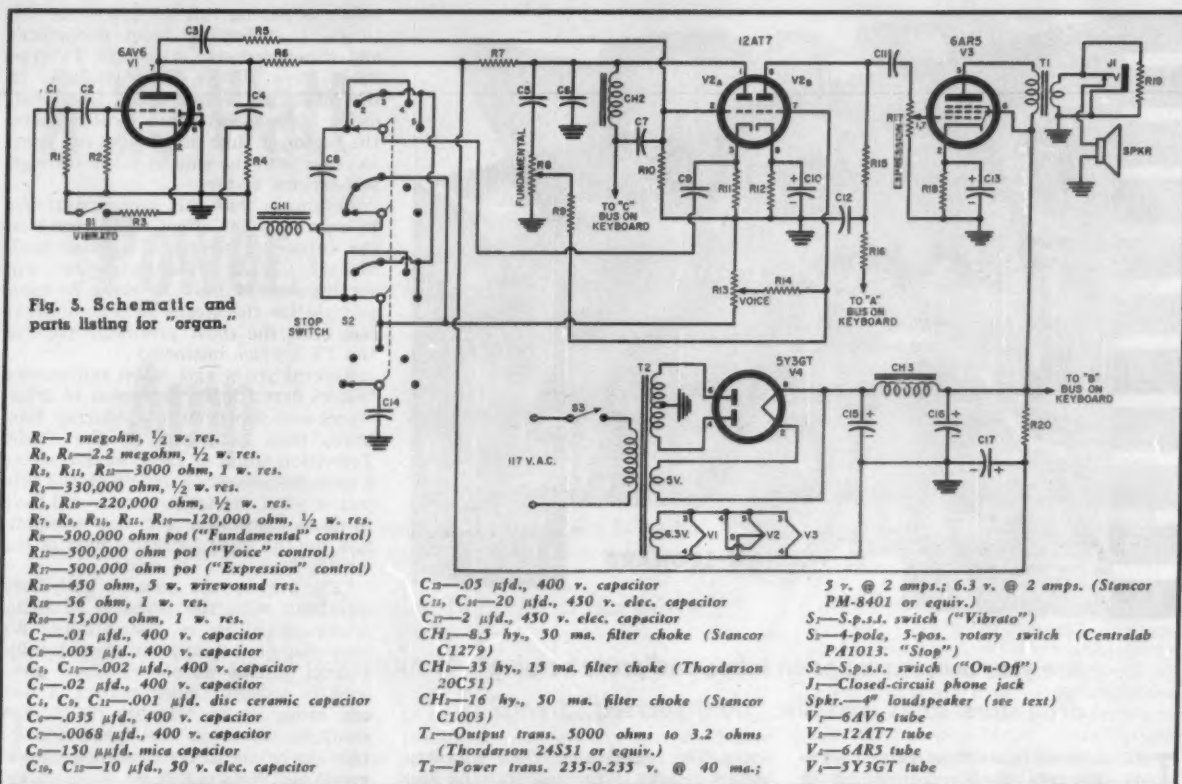


Fig. 3. Shown here in this construction drawing are the details of the author's music rack arrangement. Other setups may be used if more convenient for the individual builder.

Fig. 4. Partial schematic showing wiring of push-button switches. Three interconnections are made to main schematic on opposite page. For component values see Table 1.





Since the wiring of each of the 25 push-button switches is almost identical, the schematic has been simplified by showing only two switches in Fig. 4. The A, B, and C terminals of each individual switch are paralleled with the A, B, and C terminals of all the other switches. The D terminals for the top 18 notes are connected to fixed capacitors, C_n , which are paralleled with the trimmers, C_p . The D terminals of the seven lowest note switches go to fixed capacitors, C_n , which, in turn, are connected to potentiometers R_p .

Since it would be almost impossible to find a fixed capacitor with the exact value required to produce resonance on a specific frequency, some method must be provided for varying the effective capacity of the oscillator tuning capacitors, C_n . This variation is obtained for the top 18 notes by means of trimmer capacitors, C_p , which parallel the fixed capacitors, C_n . Trimmers with an adequate capacity range to cover the seven lowest notes are rather expensive, therefore, zeroing in of these seven notes, "A" through "D sharp," is accomplished by means of the tuning potentiometers denoted as R_p . If you shop around a bit, you should have little difficulty finding suitable potentiometers for a very nominal sum. One thing is certain, they'll cost you a lot less than high-capacity mica trimmers.

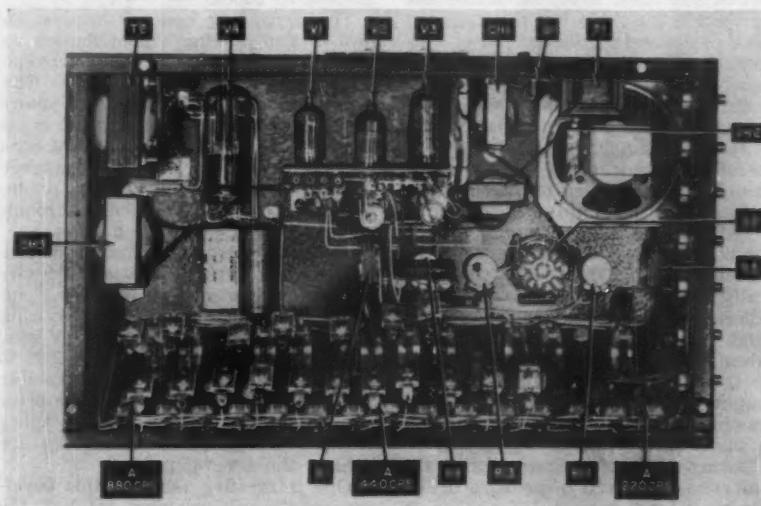
With resistive tuning, the greater the resistance of R_p , the lower the effective capacity of C_n will be. Thus, as the resistance of R_p is increased, the pitch of the note will increase, too. Obviously,

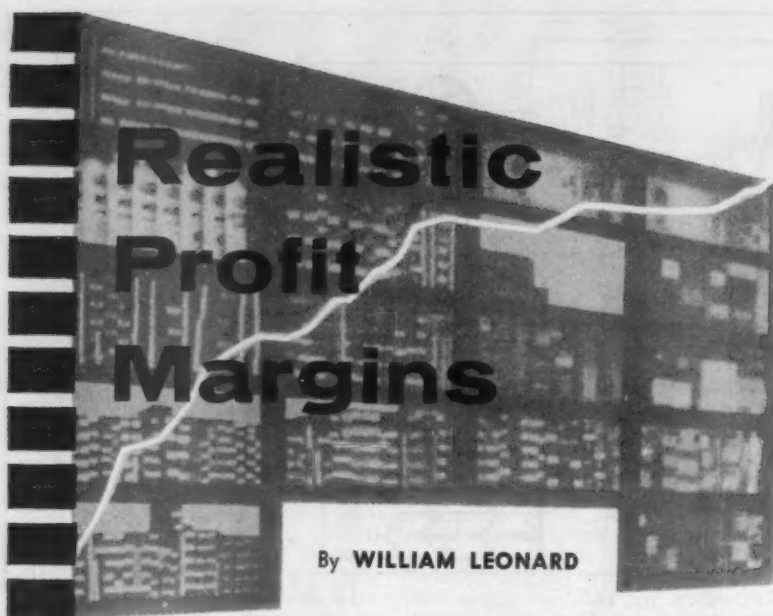
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NOTE	FREQ. (cps)	C_n (μ fd.)	C_p (μ fd.)	R_p (ohms)	NOTE	FREQ. (cps)	C_n (μ fd.)	C_p (μ fd.)	R_p (ohms)
A	220	.03	None	2500	A	440	.005	170-780 trimmer	None
A#	233.47	.023	"	"	A#	466.94	.00347	"	"
B	246.94	.02	"	"	B	493.88	.003	"	"
C	261.63	.016	"	"	C	523.25	.003	"	"
C#	277.64	.015	"	"	C#	555.29	.002	"	"
D	293.66	.012	"	"	D	587.33	.002	"	"
D#	311.64	.011	"	"	D#	623.29	.002	"	"
E	329.63	.009	170-780 trimmer	None	E	659.26	.0015	"	"
F	349.23	.008	"	"	F	698.46	.001	"	"
F#	370.61	.007	"	"	F#	741.22	.001	"	"
G	392	.006	"	"	G	783.99	.001	"	"
G#	416	.005	"	"	G#	831.99	.001	"	"
					A	880	.001	"	"

Table 1. Suggested component values for each of the 25 notes which can be played.

Fig. 6. Bottom view of unit shows placement of components. The C_n and C_p capacitors are soldered directly to terminals of their respective push-button switches. The R_p potentiometers, with shafts cut very short, are mounted along right edge.





Are your own mark-ups on tubes and parts helping drug-store sales and the "do-it-yourself" trend?

THE sales of tubes through self-service checkers have mushroomed in the course of the current economic re-adjustment. As the public tightened its purse strings, the do-it-yourself idea, which started as a fad a few years back, found new favor as a way to save money. The average householder who, out of necessity, learned how to make his own plumbing and electrical wiring repairs, grabs the chance to save the service charges for replacing burned out tubes in his TV set when he finds new tubes available at a near-by drugstore or supermarket.

In the wake of this accelerated trend toward do-it-yourself servicing, a new wave of protest against the sale of tubes to the public through self-service testers has been sweeping across the service industry. Most of the ideas put forth to counteract the spread of self-service testers in non-electronic locations center around punishing manufacturers whose brands are sold through the testers and the distributors who supply the tube-checker operators. Unfortunately, little if any thought is being given to the economic factors involved in this development.

Ten years ago the "innards" of a TV set were a deep mystery to the average person. The feeling was generally held that only a trained and experienced technician could comprehend the functions of the mass of tubes and maze of wiring that made up a TV receiver. While the public sought to buy service as cheaply as possible, there was no mass interest in the self-servicing of TV sets.

During the intervening years, the public has acquired a measure of TV servicing know-how in a number of

ways. The functioning of TV circuitry, widely taught in manual training high schools, spread a working knowledge of TV sets to a broad segment of the public. Magazine and newspaper articles explaining and describing the mysteries of TV added to the public's store of knowledge about this new force in their lives. Finally, the fast-moving TV repairmen who quickly completed three out of every four service calls in the home by replacing a few burned out or inoperative tubes, added the service industry's contribution to the public's education in TV servicing. The end result of this decade of training is that the average set owner is fairly well informed about how his TV set operates and the functions of its tubes.

The expanding general interest in hi-fi is also making a contribution to the public's knowledge of electronic circuitry and component parts. The aggressive promotion of FM in many areas is zooming public interest in it. Dealer lethargy in promoting FM tuners has left this a wide open market for the sale of kits. Here, again, public education is being broadened through construction of electronic kits.

With this steady expansion of the public's knowledge of electronic circuitry, components, transistors, and tubes, the trend toward self-servicing of electronic devices, including TV sets, will probably continue to grow. It is a natural development made possible by the wide margin between the price the manufacturer gets for the tubes and the list prices at which they are sold to the general public.

One interesting facet of this development in self-servicing is that the

public is paying full list prices for the tubes it is buying from drugstores and supermarkets. Although TV-type tubes have always been available to the public at dealers' costs from mail order houses and some local jobbers, the factor of tube prices does not seem to enter into the sale of tubes through self-service testers.

Assuming that this trend continues to expand, what effect will it have on the future of electronic service businesses? What re-adjustments will service dealers have to make to compensate for the steady decline of what has been the most profitable part of the TV service business?

Several years ago, when self-service testers first started to appear in drugstores and supermarkets, Murray Barlowe, then president of the Radio Television Guild of Long Island, wrote a thought-provoking article on the subject of what service dealers would have to do to discourage this new competition for the most lucrative part of the service business. He said:

"For over a year now we have been wrestling with the problem of indiscriminate selling by distributors. We have made substantial progress locally. But as quickly as one of these problems is brought under control, a new one crops up to take its place. For example, there is the trend toward tube sales in drugstores and supermarkets. Wouldn't it be wiser to get to the root of these problems, try to find out what creates these situations, and cut out the cause, rather than treat the symptoms?

"As always, economic factors are the motivating forces. A lucrative market is created and the sharpshooters hop in to exploit it. What created the present situation? Who's to blame? Why do distributors sell indiscriminately? Why are tubes being sold in drugstores and supermarkets? Why are there so many incompetent fringe operators? Who's to blame?

"I'll tell you who the culprit is. It's not the manufacturer nor the distributor. The real culprit is *you* and *me*, the serviceman or technician, call him what you will. We have been sitting still while the world moves by. Technically, the majority of us are right on the ball. We know all there is to know about color TV, transistors, and what makes an intermittent 'intermit,' but economically we've been fast asleep!

"While we madly cut prices on appliances and television sets in our shops, we religiously maintain the fictitious list prices on tubes. Imagine, in this day and age, buying an item for 80 cents and selling it for \$2.00! That represents a mark-up of about 150 percent. Most alert business men are satisfied to work on a margin of 30 percent on nationally advertised merchandise. Let's stop trying to be parts salesmen; we'll never get rich selling tubes. The doctors don't depend on the sale of drugs for their livelihood; they have something better to sell than

(Continued on page 121)

RADIO & TV NEWS
LAB  TESTED

The unit incorporates a conventional level-set control, "on-off" switch, power-line fuse, and a variable damping factor control. This latter control is calibrated on three separate scales for 4-, 8-, or 16-ohm output impedances. A printed circuit board simplifies the actual construction and insures correct lead "dress," eliminating the possibility of hum pickup.

presents an extremely attractive appearance. Its chrome-plated chassis and slim-line construction make the unit outstanding as far as appearance is concerned. In addition, it is extremely functional in that all the controls are mounted on one flange of the chassis, which eliminates the necessity for working from both sides of the unit when hooking it up in the circuit.

All units of this type are obtained in kit form and built and tested according
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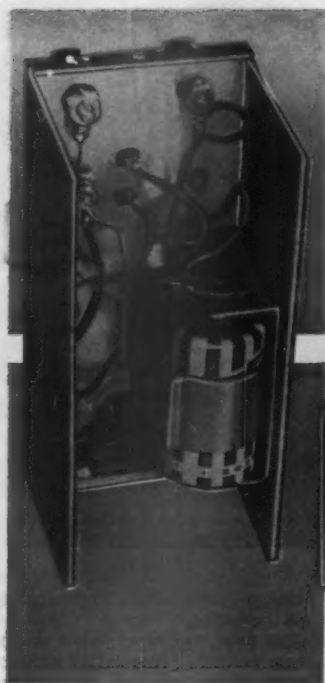


Fig. 1. (Top) Inside view of electronic buzzer shows simplicity of construction.

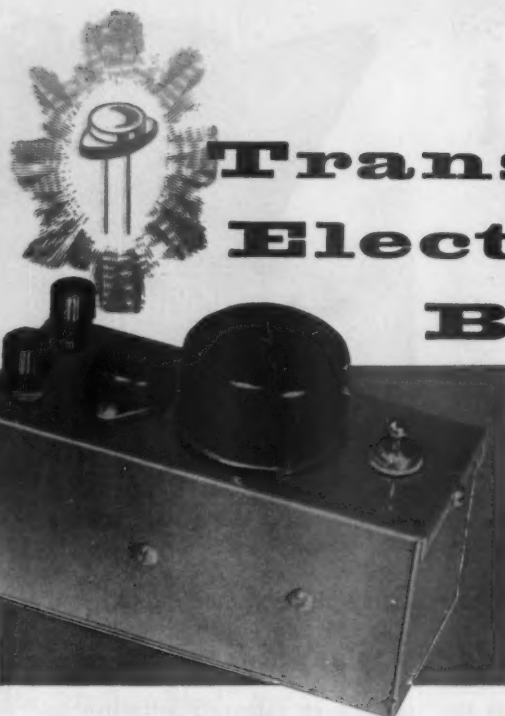


Fig. 2. (Right) Over-all view of buzzer. Top of chassis is transistor heat sink.

Transistor Electronic Buzzer

By
RUFUS P. TURNER

Construction of a simple gadget for which the ham, experimenter, and technician will find many uses.

THE buzzer is a simple device but its versatility is well known. Although it was originally intended for signal or alarm purposes only, the buzzer has found many other uses during its long history which goes back to the early days of electricity. It has been used for "ringing out" wiring, locating grounds and short circuits, telegraph communication, as a vibrator in the primary circuit of a step-up transformer, as an audio generator for impedance bridges, and even as a radio-frequency generator.

The buzzer is purely electromechanical in nature but when it is driven by a transistorized high-gain d.c. amplifier, the result is an *electronic* device which gives full buzzer operation with a tiny d.c. input signal. This electronic buzzer may be used in many applications—wherever a strong audible signal is required in response to a small d.c. input. It allows many electronic test operations to be performed by blind operators and since no connections are made to the power line, it is entirely safe for these people to use. At the same time, the sighted operator will find an aural signal useful when his visual attention is demanded elsewhere. Audio-frequency and radio-frequency control signals may be rectified with a crystal diode to supply the d.c. signal. Typical applications will be discussed later.

Circuit Description

Fig. 3 is the complete circuit diagram of the unit. The buzzer (Johnson

"Speed-X" Model 114-400) is connected in the collector circuit of an inexpensive *p-n-p* power transistor (CBS Type 2N255). The 2N255 is driven by a conventional *n-p-n* transistor (General Electric Type 2N170). Direct coupling between the two stages of the transistorized amplifier eliminates the need for resistors and capacitors. By employing an *n-p-n* transistor in the input stage and a *p-n-p* in the output stage, we can get along with 3-volts of battery power.

A signal current of only 20 microamperes at the d.c. input terminals drives the buzzer to full operation. Total current drain from the 3-volt battery is 56 milliamperes when the buzzer is running and 1.8 ma. when the signal-input current is zero. Two 1½-volt flashlight cells connected in series operate the circuit satisfactorily.

Construction

The photographs of Figs. 1 and 2 show construction details on the device.

There is nothing critical about either the construction or operation of the unit, so the reader is free to follow his own inclinations regarding layout. The author's unit is built in an aluminum chassis box 5" long, 2¼" wide, and 2¼" high (LMB No. 108). Fig. 2 shows the arrangement of the input terminals, 2N255 transistor, buzzer, and "on-off" switch on the top of the box. Fig. 1 shows the internal wiring and placement of the 2N170 transistor and batteries.

The 2N255 power transistor is bolted to the box. This connects its collector automatically to the box (chassis) since the metal shell of this transistor is its collector terminal. This direct physical contact with the box aids in dissipating any heat generated by the transistor. However, the builder must be careful to make *no other circuit connections* to the box, otherwise the collector mistakenly will become involved. The base and emitter pins of the 2N255 pass through two ¼-inch clearance holes drilled in the top of the box.

Connections are made to the base and emitter pins of the 2N255 by means of contact springs taken from a miniature tube socket. These springs slip over the pins and grip them firmly. One spring is soldered to the end of a flexible lead from the switch. The other is soldered directly to the collector pigtail of the 2N170 transistor.

The base and emitter pigtails of the 2N170 transistor are soldered to a 2-lug insulated terminal strip. This makes a simple, convenient mounting for the transistor. When soldering to a pigtail hold the lead tightly with long-nose pliers clamped between the transistor body and the point of soldering. Continue to hold until the joint has cooled completely so that maximum heat will be dissipated. This will prevent damage to the transistor.

The two 1½-volt flashlight cells are slipped into a bracket-type battery holder mounted on one inside wall of the box, as shown in Fig. 1. You can

use a *Philmore* Model 173 holder for Size-C cells or Model 176 for Size-D cells.

Insulated binding posts are used as the d.c. input terminals. These binding posts come with fiber washers which insulate their screws, nuts, and lugs from the chassis. The clearance holes for these posts are $\frac{1}{4}$ " in diameter.

A $\frac{1}{2}$ "-diameter hole is required for the s.p.s.t. toggle switch and two $\frac{3}{16}$ "-diameter clearance holes for the leads from the buzzer.

Do not place the batteries in the holder until the wiring has been checked and found to be correct.

Initial Testing

After construction is completed, the electronic buzzer may be tested in the following manner: (1) Set the "on-off" switch to its "off" position. (2) Connect a $1\frac{1}{2}$ -volt cell, 0-50 or 0-100 d.c. microammeter, and 100,000-ohm rheostat in series with the d.c. input terminals. Be sure the positive terminal of the cell is connected to the positive terminal of the buzzer unit. Set the rheostat to its highest resistance. (3) Throw the "on-off" switch to its "on" position. (4) Slowly decrease the resistance of the rheostat, observing that the input current, as indicated by the meter, rises. (5) At approximately 20 microamperes, the buzzer will go into operation. (6) Decrease the input current, observing that the buzzer goes out of operation. (7) The tone of the buzzer may be raised or lowered, as desired, by adjusting the spring-tension screw.

Applications

The many uses of the electronic buzzer include such applications as high-sensitivity telegraph signalling, continuity testing, signal tracing, high-gain alarm systems, etc. Fig. 4 shows some typical applications. The alert reader will think of many more.

Low-Current Alarm. In Fig. 4A the operating signal is supplied by a $1\frac{1}{2}$ -volt cell through a 30,000 ohm, $\frac{1}{2}$ -watt resistor. The two leads go to any type of ordinary contacting device such as make-and-break contacts, push-button, commutator, mercury switch, liquid level probes, etc.

The advantage of this scheme is that the very low operating current prevents sparking and sticking of the contacts and permits the use of light-duty contacts. It will be useful wherever the operating current must be held to a low value.

If the series resistor is omitted from the set-up shown in Fig. 4A, this gadget will "read" code from dots and dashes made on paper tape with ordinary lead pencil.

Photoelectric Buzzer. Fig 4B is the circuit which provides a d.c. operating signal supplied by a self-generating photocell. When a low cost silicon solar cell is used (*International Rectifier* Type SA5-M), a regular 2-cell flashlight will operate the buzzer at a distance of three feet. Longer distances

may be covered with 115-volt lamps if lenses are used.

Radio-Operated Alarm. See Fig. 4C. The inductance L and capacitance C_1 of the tuned circuit are chosen to resonate at the carrier frequency of the c.w. control signal. The 1N34 diode rectifies this signal and the resultant direct current operates the electronic buzzer.

For operation from a near-by high-frequency transmitter in the Citizens or amateur bands, the antenna may be a vertical rod or whip. For operation over appreciable distances, however, a good outside antenna and ground must be used even when the transmitter is relatively high-powered.

Audible Wavemeter. The circuit shown in Fig. 4D will provide an audible signal to indicate that the $L-C_1$ combination is tuned to resonance with an r.f. carrier. The r.f. is rectified by the 1N34 diode and the resultant direct current operates the electronic buzzer. The inductance of the coil L and the tuning capacitance C_1 are chosen for coverage of the desired frequency range.

We have operated this circuit successfully from the relatively low output of a service-type test oscillator link-coupled to coil L .

Code Reproducer. A receiver without a beat oscillator, such as an all-wave broadcast receiver, cannot be used for c.w. signals. The electronic buzzer will, when connected to a receiver of this type, reproduce the signals with loud-speaker volume. Fig. 4E shows the arrangement.

The lead from coupling capacitor C is clipped to the 2nd detector input terminal. This usually is the top of the secondary of the last i.f. transformer (2nd detector input transformer). The 1N34 diode rectifies the signals and the resultant d.c. pulses operate the electronic buzzer. The value of resistance R must be determined experimentally, since the 2nd detector signal voltage has different amplitudes in different receivers. It will be between 15,000 and 750,000 ohms.

Overmodulation Alarm. In the set-up shown in Fig. 4F, the buzzer sounds each time the AM transmitter to which the unit is coupled is modulated in excess of 100%.

The r.f. pickup coil is 2 inches in

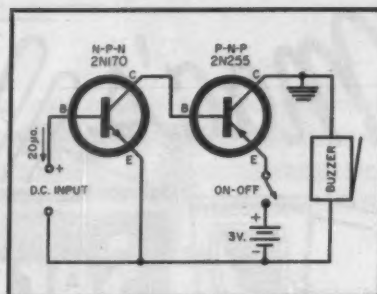


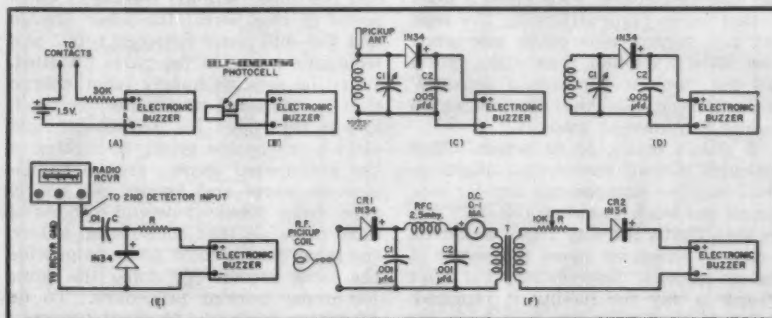
Fig. 3. Complete schematic diagram of the transistorized electronic buzzer. An ordinary buzzer is connected in the collector circuit of an inexpensive "p-n-p" power transistor (CBS Type 2N255). This is then driven by a conventional "n-p-n" transistor (G-E Type 2N170). Direct coupling between the two stages of the transistorized amplifier does away with the need for resistors and capacitors. A 20- μ a. signal current is enough to drive the circuit fully.

diameter and wound with 2 or 3 turns of insulated hookup wire. It is coupled to the tank of the modulated r.f. stage of the transmitter. The coupling is adjusted to bring the deflection of the milliammeter to exactly half-scale (0.5 ma.). The signal is demodulated by the first 1N34 diode, CR_1 . The audio output (proportional to the modulation envelope) is coupled by transformer T to the buzzer circuit. The r.f. choke (RFC) and capacitors (C_1 and C_2) form an r.f. filter. Transformer T has a 1:1 ratio (*Stancor* Type A-8102 or equivalent).

This set-up must be adjusted against an oscilloscope (set up for modulation measurement) or a per-cent modulation meter. The coupling between the transmitter tank and pickup coil is adjusted for half-scale deflection of the milliammeter. After this is done, increase the transmitter modulation to just a little more than 100%. Finally, adjust the 10,000-ohm rheostat R so that the buzzer operates at this point. Reduce the modulation to exactly 100% where the buzzer should stop operating. (If it does not, increase the resistance setting of rheostat R and repeat the test).

Undoubtedly the builder will be able to think of many more applications for this device. The foregoing are just some suggestions. —50—

Fig. 4. Shown below are just a few of the possible applications of the electronic buzzer. (A) Low-current alarm, (B) photoelectric buzzer, (C) radio-operated alarm, (D) audible wavemeter circuit, (E) code reproducer, and (F) overmodulation alarm.





By JOHN T. FRYE
CHISEL BLUNTERS

"AND since this radio is all the poor old fellow has for enjoyment, I told him I'd take it and have it repaired for him," the fat man was saying to Mac as Barney came into the shop after making a service call. "Naturally, I can't afford to put too much into it; but now you understand the circumstances, I'm sure you'll keep your charges to a minimum."

"As a matter of fact," Mac replied gently, "we shall have to charge the same for repairing this set as for any other. We make it a standard shop practice to keep our business and our charity work entirely separate. We give as generously as we can to the Community Fund, the Red Cross, and all the other worth-while charities—and you know how many of them there are these days—but when we make out a bill for a repair job, we charge the same fair amount for the work listed, no matter whose name appears on that bill. If we had a different charge-rate for every individual, we'd soon lose the confidence of our customers and be forced to ask for charity instead of bestow it. I know a man of your business ability understands this when it is pointed out to you."

"Of course, of course!" the fat man said hurriedly as he wiped his red face with his handkerchief. "I simply wasn't thinking. You go ahead and fix that set up right, no matter what it costs, and I'll pay for it."

"Hey, Boss," Barney said softly after the man had gone; "you fibbed a little to that man. Time after time I've seen you put several new parts into some poor devil's set and then make out a bill for 'broken connection repaired' or something like that so you could charge a minimum amount."

"I didn't really lie in words," Mac defended himself sheepishly. "Remember I said we charged our regular rate for all the work 'listed on the bill'; and we do. That's the way I like to handle a case in which we know the owner of the set actually deserves help but can't afford to pay for having it repaired. Doing it that way lets him keep his

pride, which is important. He has asked no favors and, as far as he knows, has received none."

"This other arrangement our chubby friend was trying to put over is altogether different. It costs the set owner his pride; it costs us our labor and parts; and the tinhorn Samaritan gets credit for doing a charitable deed! Yet it is surprising how often this proposition is presented, with varying degrees of subtlety, to the service technician."

"Well, I'll say this: you certainly did a neat job of blunting that would-be chiseler's chisel!"

"That job is a good bit like the one of pasting on wallpaper," Mac said with a chuckle. "Either you do it neatly or you have an unholy mess on your hands. Having to say No or point out that a person is in the wrong is always a ticklish business. One false move and you've made an enemy for life. Never forget the quotation: 'You can't always say Yes, but you can always say No graciously.' The real trick is to be careful to leave the customer with a graceful, face-saving retreat from his or her unreasonable position."

"How do you handle the joker who buys parts from a wholesale catalogue and wants you to install them for the same labor bill you would charge for putting in your own parts?"

"Give him the straight facts. Explain that what a service technician really sells is his technical knowledge and his time; but his income is composed of two parts: the labor charge and the difference between retail and wholesale prices of the parts installed. When he sets an hourly labor charge that is estimated to pay his overhead, give a return on his investment, and yield a reasonable profit, he figures in the anticipated income from commission on parts and lowers the hourly rate from what it would otherwise have to be. If that commission is lost, the labor charge must go up to provide the same income for doing the same job under normal procedure. To do otherwise is simply to cheat yourself;

and in this shop we do not want to cheat anyone—either the customers or ourselves."

"I like that last statement," Barney said. "It sort of leaves hanging in the air the idea that we don't want anyone else cheating us, too; but it doesn't actually say it. Here's another for you: what kind of psychological jiu jitsu do you use on the fellow who brings in three or four old junker radios and says that if you will just fix up one so it will play he will give you the others for 'parts.'"

Mac grinned knowingly as he replied. "Ah, yes! We usually get an epidemic of that sort of thing in the spring when folks start cleaning out the attics. This is a place to be very firm and clear. Never, under any circumstances, let anyone give you an old radio for 'parts.' Explain that you do not have the slightest use in the world for old sets because you never install anything but brand-new parts that you can guarantee. If the customer wants you to examine the sets at your regular estimate charge per set, you will be glad to do so and to make recommendations as to which, if any, are worth repairing and which one would be the best choice. Then, if he wishes, you will be glad to make the repairs at your regular prices. He can pick up the other sets and junk them. If he does not want to bother to take these sets with him, make a point of heaving them into the trash barrel in his presence. Never give anyone the slightest excuse in the world for starting a rumor that we install used parts."

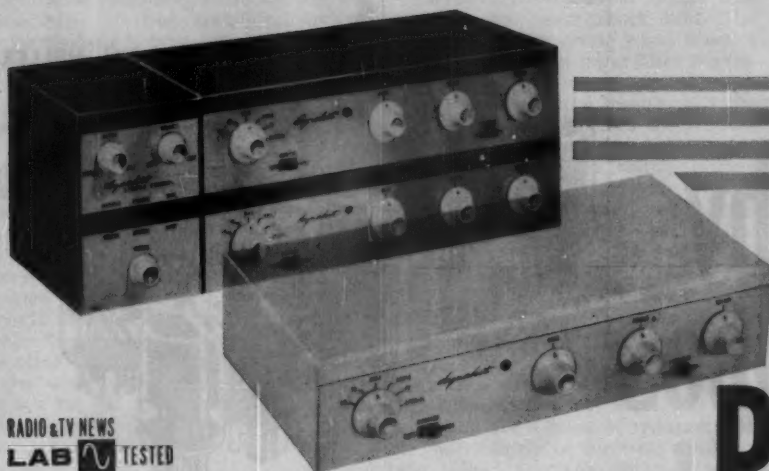
"Check!" Barney agreed. "A character that makes my tired blood boil is the one who tries to set our service charge in advance by saying something like, 'Now I don't want to put more than a couple of bucks into this job.' What do you do about him?"

"Well I wouldn't go quite as far as one technician I know. A fellow came into this technician's shop and set an old beat-up set down on the bench with the remark, 'I want this fixed, but I don't want to put more than a couple of dollars into it.'"

"Paul, the technician, grabbed up the set like it was scorching his bench and shoved it into the astonished customer's arms. 'Gosh, man,' Paul said, 'be careful where you set that receiver on my bench. You just put it down on a five-dollar spot and that's one of the cheapest areas. There aren't any two-dollar spots on that bench!'"

"Actually, the thing to do is to point out that your minimum estimate charge just for examining the set is a substantial portion of the figure named and would leave practically nothing for actual repairs. If the receiver isn't worth more than a couple of dollars to him when it's working right, he'd better not leave it, for the chances are excellent it can't be repaired for that small sum. He will simply be out the estimate charge to establish that this is a fact."

(Continued on page 118)



RADIO & TV NEWS
LAB TESTED

The Dyna Company's stereo approach is similar to Fairchild's where two identical preamplifiers are used in conjunction with control unit.

THE DYNA PREAMP

A simple design that is extremely easy to build—yet provides exceptionally good performance.

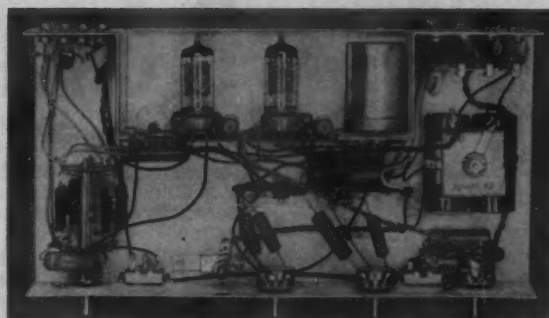
WE HAVE received an unusual number of requests from our readers asking our opinion on Dyna Company's recently introduced preamplifier. Although this component has received a considerable amount of attention in the form of reviews in other publications, we felt that in view of the demand this report was justified.

The unit, which has no particular model number, is of slim-line construction, making it an extremely compact and attractive addition to any hi-fi system. It is one of the simplest preamplifiers to build from a kit that we have yet encountered. Much of this is due to the omission of a self-contained power supply. The preamp is designed to be operated from any power amplifier that can supply 6.3 volts a.c. at .75 amp. and 200 to 400 volts d.c. at 3 to 4 ma.

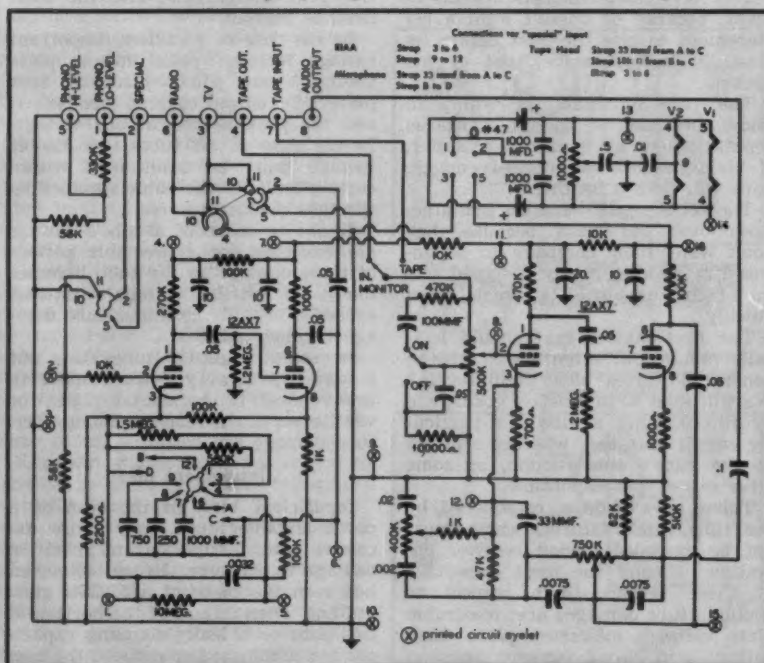
One of the features of the unit is a built-in heater rectifier supply, permitting all tubes to operate with d.c. on the heaters. This reduces to a minimum many of the hum problems inherent in preamplifier designs. Further simplification was accomplished by confining the design solely to basic controls. They are: volume, bass, treble, and a six-position selector switch (LP, 78, RIAA, radio, TV, and special). In addition, there are two slide switches, one for tape and the other for loudness. The various inputs are for both low- and high-level magnetic cartridges, radio, TV, tape, and special optional low level. There are two output jacks, one for tape and the other for regular audio. Sufficient gain is provided by the use of only two 12AX7 tubes.

The first 12AX7 tube operates as a
(Continued on page 106)

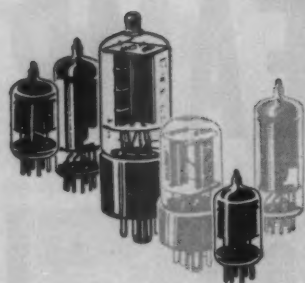
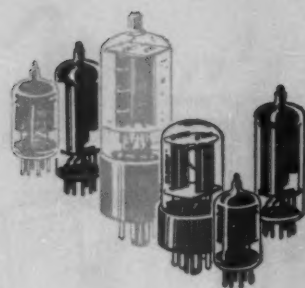
Internal view shows simplicity of design. Since unit does not include its own power supply, it must be powered externally. Most any power amplifier will supply the necessary voltages.



Complete schematic of Dyna preamp. Unit requires an external source of power.



By SOL HELLER



Why Tubes Fail Prematurely



*Don't be too quick to blame the tubes themselves.
Here are some of the many other things to check.*

TUBES, like humans, may live normal lives and die of old age—or they may be carried off prematurely, possibly in the first flush of youth. When they die prematurely, several groups of mourners want to know why.

The service technician wants to know, because he doesn't want a replacement to bite the dust before its time. It means money out of his pocket.

The tube manufacturer wants to know, because he doesn't want his reputation—or his bankroll—to suffer. If his tubes are not rugged enough, both will take a beating.

The set designer—and set manufacturer—want to know because they don't want their company to be accused of making poorly designed sets in which components break down quickly.

The first matter that should logically occupy our attention is, why in general do tubes blow prematurely? We will then be in a better position to figure out, when a tube in a particular circuit goes bad, whether a defect in the tube's construction, or some other cause, was responsible.

Tubes have ratings, established by the tube manufacturer, which must not be exceeded during receiver operation. Among the most important of these ratings (with respect to avoiding tube damage) are: maximum plate voltage; maximum plate dissipation; grid No. 2 (screen) voltage;

grid No. 2 input (screen dissipation); and peak heater-cathode voltage. In the case of some tubes, these additional ratings are important: maximum positive bias (extent to which the control grid may go positive, with respect to the cathode); grid No. 1 input (control grid dissipation); and the total cathode current.

In the case of rectifiers, important ratings include: peak inverse plate voltage; peak plate current (per plate); d.c. output current (per plate); and the peak heater-cathode voltage. In the case of all tubes, the heater voltage must be maintained within certain limits of the value specified by the tube manufacturer.

If one or more of a tube's ratings are exceeded for appreciable periods of time, damage to the tube becomes likely. If the line voltage variations exceed $\pm 10\%$, for example, tube damage becomes possible.

In some cases, if tubes are not mounted properly, with respect to the vertical or horizontal plane, or ventilation of the receiver is improper, tube damage can result.

Insufficient Bias

Insufficient bias, in the case of a power-amplifier tube, may cause excessive plate dissipation and result in damage to the tube. Every technician has seen the plate of a 6BG6G glow red hot, when failure of the horizontal oscillator or a leaky coupling capacitor has eliminated or reduced the bias

of the horizontal-output tube and increased its plate current. The heat generated, in some cases, is so great that the solder in the plate cap melts, causing the plate clip and plate cap of the tube to become soldered together.

When a horizontal-amplifier tube has been replaced, you should take out an "insurance policy" on its successor's life by checking for the amount of drive to the tube. This can be simply and quickly done by manipulating the drive control. Advance the control until overdrive lines (vertical white lines) are seen in the picture. Then turn the control back to a setting where the lines just disappear. When overdrive lines cannot be obtained, insufficient drive to the tube may be present. If the life of the original tube was short, a scope test of the drive-signal amplitude, as well as the bias of the horizontal-output tube, is warranted.

An erratically oscillating horizontal-oscillator tube may be the reason that a horizontal output tube has had a short (but not merry) life. This kind of trouble can be added to the list of suspects if the customer reports that the screen used to go dark at intervals, before a continuous darkness descended over the commercials. When the horizontal oscillator is a 6SN7GT, such trouble is particularly likely.

When a horizontal-output tube has had a short life and the set is a series-filament type, the explanation may lie in an open in one of the series fila-

ment lines (assuming there are two in parallel). If the horizontal-output tube filament is in one filament string, and the horizontal oscillator in another, trouble in the second string may remove drive from the output tube by making the oscillator inoperative.

Another tube that tends to be highly allergic to loss of bias is the front-end (r.f.) oscillator. When this local oscillator has a substantial plate voltage, and negative grid bias is lost because of some circuit fault, the tube itself is very likely to be damaged if it is operated without bias for an appreciable length of time. A characteristic milky color (produced by the release of gas) is often seen in the upper part of the tube under such conditions. A bias check of the r.f. oscillator stage is therefore not unwarranted when premature demise of the tube is encountered.

A leaky coupling capacitor in a video i.f. stage not infrequently produces short life in a video i.f. tube.

A low-voltage rectifier may take the long count because of reduced bias in a high-current tube, or in several tubes, of the particular set. A short-circuit to ground of a bias resistor in the negative return of a rectifier (R₁ in Fig. 1) for instance, can cause the rectifier to overheat and become damaged. A short between the electrodes of some tube other than the rectifier can also cause rectifier current overload and resultant damage.

Plate and Screen Current

A circuit defect that eliminates plate-current flow in a high-current tube, but permits screen current to flow in that tube, is likely to cause screen dissipation to be exceeded, since electrons that normally travel beyond the screen, to the plate, will now pass through the screen circuit. An open-circuit in a flyback transformer, or in the output transformer of an audio power-amplifier stage, may cause such a condition. An inoperative damper tube, in the case of some TV receivers, can result in the removal of plate voltage from the horizontal-output tube, without causing the screen current of the tube to be interrupted.

Sometimes a defective horizontal-output transformer—or a replacement transformer that is not the correct type—can dispose of the horizontal-output tube before its time. Excessive plate dissipation is what damages the tube under such conditions.

Premature death of a low-voltage rectifier is sometimes due to the fact that the tube is being worked too close to its maximum current ratings. An increase in line voltage, or some circuit trouble that causes the d.c. current passed by the rectifier to increase, can readily push the tube over the top. One set manufacturer, for example, ran into this trouble when he used a 5Z4 as rectifier in one of his TV chassis. Replacement of the 5Z4 by a 5V4G, whose plate current ratings are considerably higher, remedied the trouble.

Excessive plate current surges in a rectifier can cause short life. The surges commonly occur when a set is first turned on. An input filter capacitance that is too large in value is one possible source of the trouble. A technician sometimes replaces the original capacitor with one of a larger value in order to boost the d.c. voltage output of the rectifier. He may not realize that the "boost" is really a "knock," in this case, with respect to rectifier life!

High Heater Voltage

Excessive filament voltage reduces the life of a tube's heater. It also damages the cathode. In series-filament receivers, the voltage surges that take place when the set is first turned on are a cause of reduced tube life, particularly in the case of older-type tubes. Specially designed tubes of more recent vintage, such as the 3AL5, 5AQ5, etc., are less vulnerable to voltage surges. In some TV receivers, an open circuit in the filament of a tube in one string may expose the filaments of tubes in another string to excessive voltages. An open circuit in a resistance that is in parallel with a tube filament will also cause a larger-than-normal voltage to be developed across the filament.

When a blown pilot light in a radio using a 35W4-type rectifier (see Fig. 2) is not replaced immediately, and the radio is operated without the replacement, the rectifier's life will be greatly reduced. The reason is that the voltage developed across the section of the filament with which the pilot light is in parallel is increased; the voltage surge that appears across this section of the filament when the set is first turned on is, not infrequently, large enough to blow it at once.

In some instances, short life of a tube in a series-filament string is due to an excessively low cold resistance of one of the tube filaments in the string. Tube filaments in series with the filament in question will be subjected to higher-than-normal surge voltages, and short life of one or more of these tubes becomes possible. When a premature open filament is encountered in the case of a series-filament set, and no more likely cause of the trouble can be found, it is worth while to check the cold resistances of the filaments in the string affected. The values of resistances obtained should be compared with the filament resistance values of identical-type new tubes. An ohmmeter capable of reading very low values of resistance accurately will be needed in the case of some tubes.

Excessive filament voltage is also a possible cause of premature failure of a high-voltage rectifier. The excess may be due to a higher-than-normal line voltage; to decrease in the value of the filament-dropping resistor in series with the rectifier; to arcing between plate and filament of the rectifier; or to improper positioning of the filament winding on the core of

the set's flyback transformer itself.

Tests for the presence of most of these troubles are familiar; the only condition that warrants comment is arcing between plate and filament. Such arcing occurs when the peak inverse plate voltage rating of the rectifier is exceeded. The only commonly used rectifier that is likely to suffer from this trouble is a 1X2, due to its relatively low inverse peak voltage rating—15,000 volts—compared to a 30,000-volt peak rating for a 1B3. Replacement of the burnt-out 1X2 with a 1X2A, which has an inverse peak voltage rating of 20,000 volts, will greatly reduce the likelihood of premature failure.

Low Heater Voltage

Many technicians are not aware that insufficient filament voltage may shorten tube life. Here's the reason: Nearly all receiving tubes have oxide-coated cathodes which operate at a temperature of approximately 777 degrees centigrade. When a cathode of this type is operated at a temperature considerably below 777 degrees (due to a decrease in filament voltage), and electrode voltages other than the filament's are normal, the cathode coating is damaged. This occurs because the space charge (cloud of electrons) in the vicinity of the cathode, which normally limits plate and screen currents to safe values, is no longer large enough to perform such a protective function. The peak currents the cathode may supply under the circumstances are in excess of what it was designed to deliver. Arcing between cathode and other electrodes, as well as coating damage due to excessive peak currents, becomes possible.

Insuring that filament voltage is normal is especially important in the

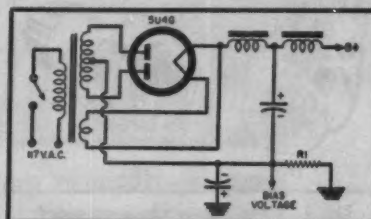
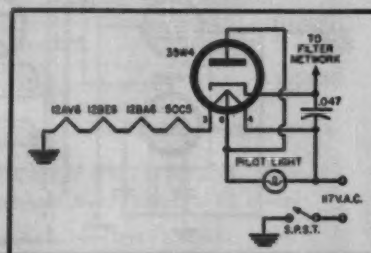


Fig. 1. A drop in bias voltage may cause several tubes in a set to be overdriven, overtaxing the rectifier.

Fig. 2. Failure to replace a blown pilot light tapped across a rectifier filament may hasten death of tube.



case of the high-voltage rectifier and the cathode-ray tube. In the case of the high-voltage rectifier, normal filament voltage gives the best chance of long life to a tube that is perhaps subject to greater stresses than any other tube in the receiver. In the case of the picture tube, it is important to avoid below-normal filament voltage—as well as any other deviation from normal electrode voltages—because of the expense of a replacement.

Heater-Cathode Voltage

When the peak heater-cathode voltage of a tube is exceeded, the insulation between heater and cathode is likely to break down, either partially or completely. The technician is well-advised to check the difference between heater and cathode potentials when an expensive tube has developed a cathode-heater short, or considerable leakage between the two electrodes. Many breakdowns between the cathodes and heaters of cathode-ray tubes have been reported; an excessive potential difference between these electrodes is often responsible. The trouble is likely to develop when the peak cathode-heater voltage rating of a tube is a relatively low one.

Damper tubes are notorious for cathode-heater breakdowns, due to the very large pulse voltages that often develop, or tend to develop, between cathode and ground. Breakdown between cathode and heater of the damper may damage the heaters of other tubes that are connected in parallel or in series with the damper filament. When premature failures of damper tube filaments, or filaments of other tubes tied in with the damper heater, are encountered, a check should be made, to determine whether

a damper cathode-bypass capacitor has open-circuited, or a connection between a positive line and the damper filament has been interrupted. (The positive line connection reduces the difference in d.c. potential between damper filament and cathode.)

Improper Lead Dress

Cases have occurred where a tube has been destroyed because of sustained arcing between a high-voltage lead and the envelope of the tube. A number of instances involving the plate lead of a 1B3 high-voltage rectifier and the envelope of a 6W4 damper were reported by one set manufacturer. A tell-tale marking on the tube envelope will generally indicate that such arcing has taken place, and requires remedying before the tube is replaced.

Insufficient Ventilation

Proper ventilation is needed to keep the temperature of a tube envelope from exceeding a safe value. Excessive heating of the envelope promotes gas formation within the tube. Good ventilation is particularly important in the case of high-current tubes, such as video amplifiers, deflection output tubes, audio power amplifiers, and low-voltage rectifiers. Approximately half of the heat of the tube envelope is dissipated by convection, or the flow of air currents past the tube; the other half is dissipated by radiation. Convection requirements demand that cool air be permitted to flow among the tubes. When a customer places the back of his set flush up against a wall (assuming that the back of the set permits such flush positioning), proper convection cooling is not likely, and excessive heating of the tubes may shorten the lives of one or more of them.

Proper heat dissipation via radiation requires that surfaces cooler than the tube envelope be near the tube, so that the tube can radiate its heat away to the cooler surfaces. If the set designer has not provided conditions suitable for proper radiation of heat—if he has, say, mounted a large, high-wattage resistor near a rectifier tube, causing surrounding surfaces to become hot—long life for the tube is not likely.

Sometimes a set manufacturer places a shield around a high-current tube, forgetful of the serious rise in envelope temperature that such a pro-

cedure produces. Numerous subsequent reports of tube breakage cause a production change to be hurriedly issued, requesting removal of the shield. The moral to the technician is, never put a shield around a high-current tube, to remedy some trouble or other; the disease may be cured, but the patient will die.

(EDITOR'S NOTE: If you feel a tube shield is really necessary, try puncturing several holes along its surface. While this will scarcely impair shielding action, it will also permit better cooling. Thus, a second moral: sometimes you can eat your cake and have it.)

Tubes mounted on vertical chassis are particularly subject to overheating, and require especially good ventilation for assurance of long life.

Servicing Hazards

When the service technician's experience is not extensive, tube damage from time to time is inevitable. Space is not available here to discuss all the possible ways by which the inexperienced technician may produce premature tube failure; some of the less common ones, however, will be considered.

When a set using a pair of parallel-connected horizontal-output tubes (see Fig. 4) is being serviced, and the set is turned off briefly to permit one of the tubes to be replaced, the second one may be damaged if the set is immediately turned on again. The second tube is still hot, while the replacement for the first one is cold; an unequal distribution of currents consequently takes place between the tubes. The hot tube may draw excessive plate current long enough to be damaged before the new tube heats up. To prevent such damage, the second tube should be allowed to get cold, before the set is turned on.

When a TV set is turned on its side for servicing and left in this position for a considerable period of time, damage to certain makes of 5U4 tubes may occur. In the types referred to, filament and plate are in a horizontal plane when the tube's long axis is parallel to the workbench (see Fig. 3). A slight amount of expansion and sag in the filament may cause a short between filament and plate. In other 5U4's the relation of keyway to electrode structure is such that the filament and plate are in a vertical plane (Fig. 3B) where the tube's long axis is parallel to the workbench, making a filament-to-plate short due to sag much less likely. Because of this phenomenon it is well to check any 5U4 replacement that will be mounted in any but the upright position.

Sometimes technicians who are connecting the audio amplifier of a TV set or radio to a record player will cause the plate and screen circuits of r.f. and/or i.f. tubes to be interrupted during phono operation. The procedure is not a wise one, since it tends to shorten the lives of the tubes involved, say tube designers.

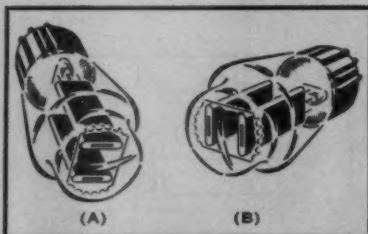


Fig. 3. When a receiver is up-ended for service, note the horizontal plane in which the elements of the rectifier fall. Certain types, when kept in the wrong position, will suffer damage due to internal sagging of the filaments.

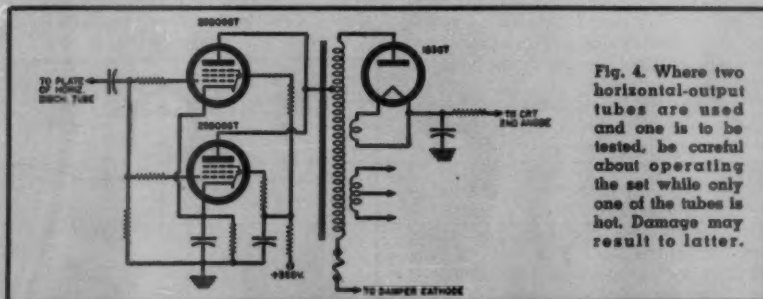


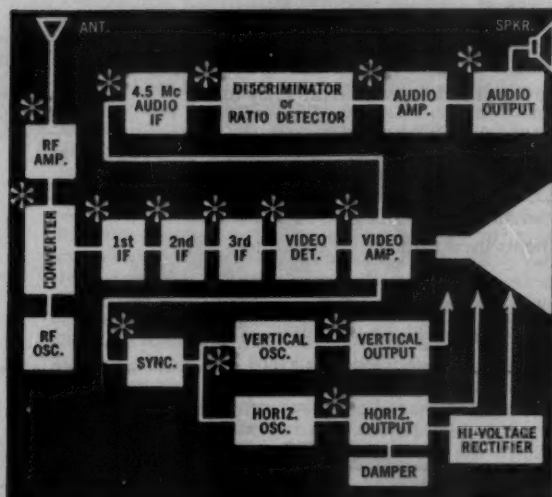
Fig. 4. Where two horizontal-output tubes are used and one is to be tested, be careful about operating the set while only one of the tubes is hot. Damage may result to latter.

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VIEWING**

TELEVISION ANALYST

**test each stage
SEPARATELY**



and watch the
result on the
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- R.F.** Supplies complete r.f. and i.f. signals with video and audio modulation to quickly trouble-shoot each stage in each of the sections of the TV receiver. Enables you to check the r.f. sensitivity and AGC settings of TV receivers.
- I.F.**
- VIDEO** Reproduces a complete test pattern on the screen of the TV picture tube and injects signals into each video stage of the TV receiver for fast, visual trouble-shooting and correction—anywhere, anytime. Makes it easy to check bandwidth, resolution, shading and contrast capabilities of the TV set.
- SYNC** Provides composite signal, sync positive and negative.
- SWEEP CIRCUIT DRIVING PULSES** Provides separate vertical and horizontal driving pulses for trouble-shooting deflection circuits.
- INTERMITTENTS** Test signal injection also aids in locating intermittent troubles.
- AUDIO** Provides a 4.5 mc sound channel, FM modulated with approximately 25 kc deviation. (This audio carrier is modulated either from a built-in 400 cycle tone generator, or from your own external audio source.) Injection of the 400 cycle tone signal simplifies trouble-shooting of the audio section.
- COLOR** Enables you to trouble-shoot and signal trace color circuits in color TV sets.
 - Generates white dot and crosshatch patterns on the TV screen for color TV convergence adjustments.
 - Generates full color rainbow pattern of orange, red, magenta, blue, cyan, green to test color sync circuits, check range of hue control, align color demodulators, etc.
- SET ADJUSTMENT** Enables you to check and adjust the vertical and horizontal linearity, size and aspect ratio of television receivers.

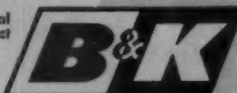


**NEW
B&K
MODEL
1075**



QUICK, DIRECT, COMPLETE TV TROUBLE-SHOOTING

Now, by point-to-point signal injection and test pattern reproduction, you can easily trouble-shoot and signal trace *any stage throughout the video, audio and sweep sections of black & white and color TV receivers.* With the remarkable new Model 1075 B&K TELEVISION ANALYST, you can quickly isolate and diagnose TV troubles (including intermittents). By use of the generated test pattern, you can *actually see* the condition directly on the picture tube of the television set itself. No external scope is needed. The TELEVISION ANALYST is practically a *complete* TV service shop in one instrument! **Net, \$259.95**



See your B&K Distributor or write for Bulletin AP12-N

B&K MANUFACTURING CO.
3726 N. Southport Ave. • Chicago 13, Illinois

Canada: Atlas Radio Corp., 50 Wingold, Toronto 10, Ont. Export: Empire Exporters, 458 Broadway, New York 13, U.S.A.

"HEATHKITS®

gave me my start and I'm still sold!"

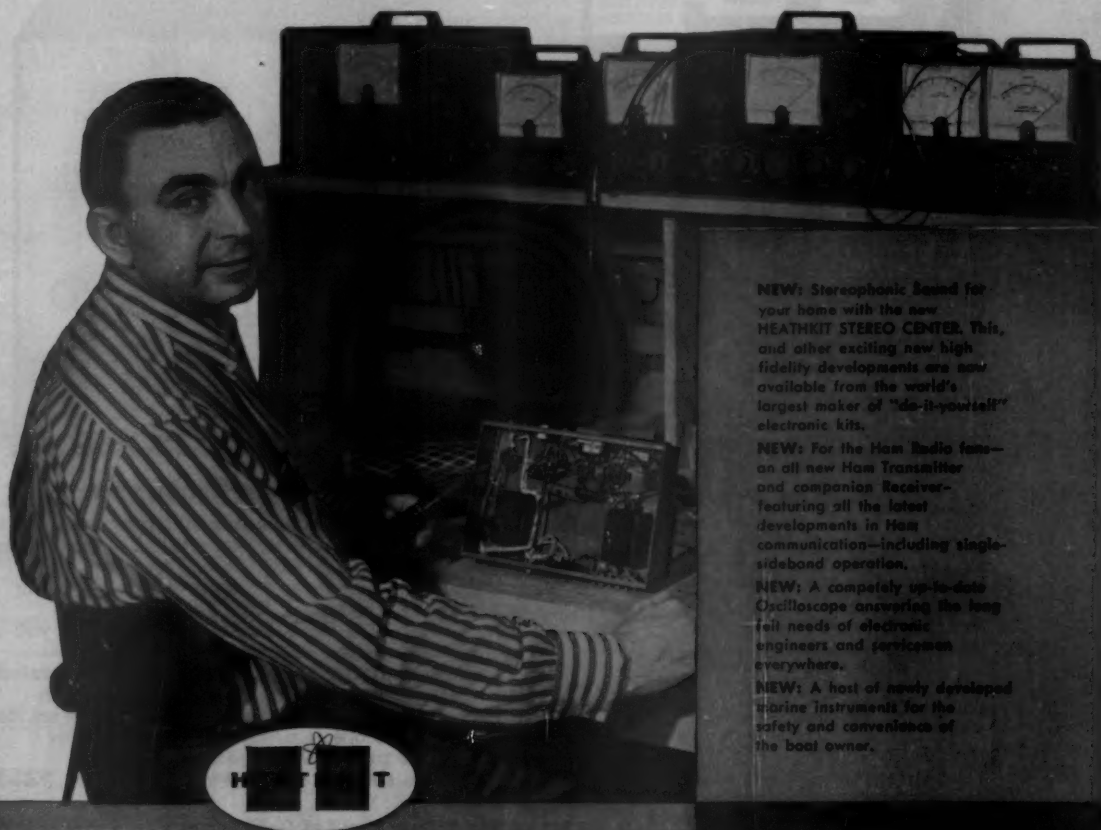
"... they are my lowest cost way to real quality and dependability in electronic equipment of any kind ...

... The clean, modern styling of HEATHKITS make me proud to own them. They make a handsome and useful addition to my workshop.

... Rigid quality standards of components used in HEATHKITS assure me of performance equal to or surpassing instruments costing many times more.

... after assembling a HEATHKIT myself, I know what "makes it tick"... I know that the thoughtful circuitry design and name-brand components used throughout guarantee me years of trouble-free service.

... HEATHKITS cost me half as much as ordinary equipment ... and I get so much more. In assembling my own instruments I am sure of the quality that goes into them. Plus the complete assembly and operating instructions as well as detailed schematics that are at my fingertips for future reference."



NEW: Stereophonic Sound for your home with the new HEATHKIT STEREO CENTER. This, and other exciting new high fidelity developments are now available from the world's largest maker of "do-it-yourself" electronic kits.


NEW: For the Ham Radio fans—an all new Ham Transmitter and companion Receiver—featuring all the latest developments in Ham communication—including single-sideband operation.

NEW: A completely up-to-date Chyloscope answering the long felt needs of electronic engineers and servicemen everywhere.

NEW: A host of newly developed marine instruments for the safety and convenience of the boat owner.



HEATH COMPANY Benton Harbor 15, Michigan

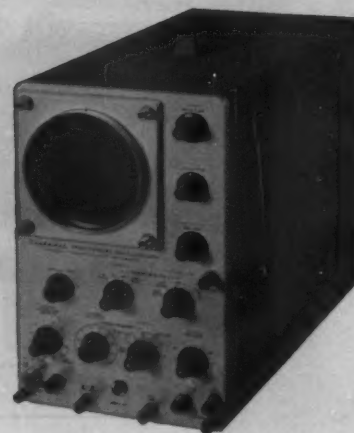
 Subsidiary of Daystrom, Inc.

The HEATH TIME PAYMENT PLAN allows you to outfit your whole workshop at one time with needed test instruments while you pay in easy monthly installments.



PROFESSIONAL OSCILLOSCOPE KIT

An exciting development in the Heathkit test instrument line is the introduction of the Heathkit model OP-1 Professional Oscilloscope. Emphasizing complete flexibility in any application, the OP-1 features DC coupled amplifiers and also DC coupled CRT tube un-blanking. The triggered sweep circuit will operate on either internal or external signals and may be either AC or DC coupled. The polarity of the triggering signal may also be selected, and any point on the wave form may be selected for the start of the sweep by using the "triggering level" control. An automatic position is also provided, in which the sweep recurs at a 50 cycle rate, but can be driven over a wide range of frequencies with no additional adjustments. The sweep frequencies are provided by switch-selected base rates of 2 and .2 milliseconds/CM, and 20, 2, and 1 microseconds/CM, in conjunction with a continuously variable 10 to 1 multiplier. Sweep frequencies are calibrated to within 10% at all control settings, and the sweep frequency may be reduced by adding capacity to the "ext. cap" binding post on the front panel. A 5ADP2 flat face CR tube is used for accurate readings on an edge lighted grid screen. A high quality conetic-ferretic CR tube shield prevents stray AC fields from distorting trace. A 12-position vertical attenuator is calibrated in volts-per-CM and the horizontal sweep is calibrated in time-per-CM. Prewired terminal boards are used for rapid, easy assembly of all critical circuits. Simply install and connect the color coded leads. Power supply is transformer operated utilizing silicon diode rectifiers and is fused for protection. Under development for over a year the OP-1 promises outstanding results in any application requiring the use of an oscilloscope.



HEATHKIT
OP-1
\$179⁹⁵

**Here's the scope you've
been waiting for!**

AVAILABLE AFTER JUNE 15



**Laboratory
Performance At Less
Than Utility Scope
Price**

HEATHKIT
O-12
\$64⁹⁵



**A Scope You Will Be
Proud To Own**

HEATHKIT
OM-3
\$39⁹⁵

"EXTRA DUTY" 5" OSCILLOSCOPE KIT

Top quality features at half the cost of ordinary equipment sum up the advantages of this popular kit. Critical observations in your laboratory or shop are handled easily, with clear, sharp pattern displays in every application. Vertical frequency response extends from 3 CPS to 5 mc ± 1.5 db -5 db without extra switching. Response is down only 2.2 db at 3.58 mc. The Heath patented sweep circuit functions effectively from 10 CPS to better than 500 kc in five steps, giving you 5 times the usual sweep obtained in other scopes. An automatic sync circuit with self-limiting cathode follower provides excellent linearity and lock-in characteristics. Extremely short retrace time and efficient blanking action. Both vertical and horizontal output amplifiers are push-pull and the scope incorporates a 1 V peak-to-peak calibrating source, step attenuated and frequency compensated vertical input, plastic molded capacitors and top quality parts throughout. The 11-tube circuit features a 5U1 cathode ray tube, and provision is made for Z-axis input for intensity modulation of the beam. Frequency response of the horizontal amplifier is within ± 1 db from 1 CPS to 200 kc. Horizontal sensitivity is 0.3 volts RMS per inch. Construction is simplified through the use of two metal circuit boards and precut, cable wiring harness. Shpg. Wt. 22 lbs.

GENERAL PURPOSE 5" OSCILLOSCOPE KIT

For servicing and routine laboratory work this fine kit is a favorite with technicians throughout the country. It incorporates many extras not expected at this low price. Features wide vertical amplifier frequency response, extended sweep generator operation, and improved stability. Frequency response of the vertical amplifier is within ± 3 db from 4 CPS to 1.2 mc. Vertical sensitivity is .09 volts RMS per inch at 1 kc. Sweep generator functions reliably from 20 CPS to over 150 kc. A modern etched circuit board is featured for high stability and reduces assembly time considerably. Standard components are mounted on this board with each position clearly marked preventing wiring errors. Both vertical and horizontal amplifiers are push-pull types. Uses a 5BP1 CRT. Provision for external or internal sweep or sync, built in 1 V peak-to-peak reference voltage and calibrated grid screen. An adjustable "spot shape" control is provided to insure a sharp trace. Input to the vertical amplifiers is through a step attenuated, frequency compensated circuit. The OM-3 is an extremely versatile instrument and has a multitude of practical uses in electronic testing fields. Particularly useful in alignment of television receivers, for testing audio amplifiers and circuits, and checking the quality of modulated RF signals in Ham Radio transmitters. Shpg. Wt. 22 lbs.



Equip Your Service Bench...



HEATHKIT
CD-1

\$59⁹⁵

Cash In Now On Color TV

- ★ 10 VERTICAL COLOR BARS
- ★ CRYSTAL CONTROLLED ACCURACY
- ★ CHOICE OF 6 DIFFERENT PATTERNS

COLOR BAR AND DOT GENERATOR KIT

Colored television is now a reality and as the number of these sets increase the need for a reliable service instrument is apparent. Nothing on the market... in this type of generator has as many features as the CD-1 at such a tremendous price saving. This unit combines two basic color service instruments, a color bar generator, and white dot generator in one versatile portable unit which has crystal controlled accuracy and stability for steady locked-in patterns (requires no external sync leads). Color receivers converged with the CD-1 will still be converged properly on a television program from the station. The 13-tube circuit has been carefully laid out for ease of assembly and provides choice of six different patterns. Produces white-dots, cross hatch, horizontal and vertical bars, ten vertical color bars, and a new shading bar pattern for screen and background adjustments. Variable RF output on any channel from 2 to 6. Positive or negative video output, variable from 0 to 10 volts peak-to-peak. Crystal controlled sound carrier with off-on switch. Voltage regulated power supply uses long-life silicon rectifiers. Kit includes three crystals and test lead, plus an information packed instruction manual covering convergence, and screen and background adjustments of a color TV set. Compare with other generators on the market and you will see that this instrument is loaded with extras and top quality all the way through. Shpg. Wt. 13 lbs.



HEATHKIT
TS-4A

\$49⁵⁰

**For fast,
easy alignment
of TV sets**



HEATHKIT
AG-10

\$49⁹⁵

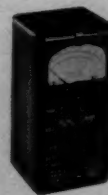
**Sine and
square waves for
countless uses**



HEATHKIT
MM-1

\$29⁹⁵

**High accuracy
in a
portable meter**



HEATHKIT
M-1

\$17⁹⁵

**An all-round
meter of
many uses**

TV ALIGNMENT GENERATOR KIT

This generator has many special design features for flexible, easy operation and reliability. The all-electronic sweep circuit insures stability and covers 3.6 mc to 220 mc in four bands. Sweep deviation is controllable from 0 to 42 mc. Crystal and variable marker oscillators are built in. Crystal (included with kit) provides output at 4.5 mc and multiples thereof. Variable marker provides output from 19 to 60 mc on fundamentals and from 57 to 180 mc on harmonics. Effective two-way blanking and phasing control also provided. A truly outstanding number of features at a tremendous price saving. Shpg. Wt. 16 lbs.

SINE-SQUARE GENERATOR KIT

High quality sine and square waves are produced by this generator over a wide range. Frequency response is ± 1.5 db from 20 CPS to 1 mc on both sine and square waves, with less than .25% sine wave distortion, 20 to 20,000 CPS. Output impedance is 600 ohms on sine wave and 50 ohms on square wave (except on 10 volt range). Square wave rise time less than .15 microseconds. Five-position bandswitch—continuously variable tuning—shielded oscillator circuit—separate step and variable output attenuators in ranges of 10, 1 and .1 volts with extra range of .01 volt on sine wave. Shpg. Wt. 12 lbs.

20,000 OHMS/VOLT VOM KIT

This meter is ideal for use in field applications where accuracy is important. Employs a 50 μ a $4\frac{1}{2}$ " meter, and features 1% precision multiplier resistors for high accuracy. Requires no external power for operation (batteries supplied). Sensitivity is 20,000 ohms-per-volt DC and 5,000 ohms-per-volt AC. Measuring ranges are 0-1.5, 5, 50, 150, 500, 1500 and 5,000 volts AC and DC. Measures direct current in ranges of 0-150 μ a, 15 ma, 150 ma, 500 ma and 15 a. Resistance multipliers are x 1, x 100 and x 10,000. Covers -10 db to +65 db. Batteries and test leads are also included with this kit. Shpg. Wt. 6 lbs.

HANDITESTER KIT

Small enough to carry with you wherever you go, this fine handitester is ideal for use in portable applications when making tests away from the work bench or as an "extra" meter in the service shop, when the main instruments are occupied. The combination function-range switch simplifies operation. Measures AC or DC voltage from 0-10, 30, 300, 1000 and 5000 volts. Direct current ranges are 0-10 ma and 0-100 ma. Ohmmeter ranges are 0-3000 and 0-300,000. Top quality precision components employed throughout. Very popular with home experimenters and electricians. Shpg. Wt. 3 lbs.

with Low-Cost Dependable Heathkits



ETCHED CIRCUIT VTVM KIT

The fact that this instrument is outselling all other VTVM's says a great deal about its accuracy, reliability, and overall quality. The precision and quality of the components used in this VTVM cannot be duplicated at this price through any other source. Its attractive appearance as well as its performance will make you proud to own it. A large $4\frac{1}{2}$ " panel meter is used for indication, with clear, sharp calibrations for all ranges. Front panel controls consist of a rotary function switch and a rotary range selector switch, zero-adjust and ohms-adjust controls. Precision 1% resistors are used in the voltage divider circuit. An etched circuit board is employed for most of the circuitry, cutting assembly time and eliminating the possibility of wiring errors. It also assures duplication of laboratory instrument performance. This multi-function VTVM will measure AC voltage (RMS), AC voltage (peak-to-peak), DC voltage and resistance. There are 7 AC (RMS) and DC voltage ranges of 1.5, 5, 15, 50, 150, 500 and 1500. In addition there are 7 peak-to-peak AC ranges of 0-4, 14, 40, 140, 400, 1400 and 4,000. Seven ohmmeter ranges providing multiplying factors of $\times 1$, $\times 10$, $\times 100$, $\times 1000$, $\times 10\text{ k}$, $\times 100\text{ k}$ and $\times 1\text{ megohm}$. Center scale resistance readings are 10, 100, 1000, 10 k, 100 k ohms, 1 megohm and 10 megohms. A zero-center scale db range is also provided. Battery and test leads included with kit. Shpg. Wt. 7 lbs.



HEATHKIT
V-7A

\$24.50

World's largest selling VTVM kit

- ★ LARGE EASY-TO-READ $4\frac{1}{2}$ " 200 UA METER
- ★ 1% PRECISION RESISTORS EMPLOYED FOR HIGH ACCURACY



HEATHKIT
C-3

\$19.50

**Checks all types of
condensers accurately**



HEATHKIT
T-4

\$19.95

**Locate faults quickly
by tracing signals**



HEATHKIT
SG-8

\$19.50

**Easy-to-build—prewound
and calibrated coils**

CONDENSER CHECKER KIT

Check unknown condenser and resistor values quickly and accurately. Capacity measurements are made in four ranges of .00001 mfd-.005 mfd; .001 mfd-.5 mfd; .1 mfd-30 mfd; 20 mfd-1,000 mfd. Checks paper, mica, ceramic, and electrolytic condensers. Leakage test provides switch selection of five polarizing voltages, 25 volts to 450 volts DC to indicate condenser operating quality under actual load conditions. Electron beam "eye" tube indicates balance and leakage. A spring return test switch automatically discharges condenser under test and eliminates shock hazard to the operator. Measures resistance from 100 ohms to 5 megohms in two ranges. Shpg. Wt. 7 lbs.

VISUAL-AURAL SIGNAL TRACER KIT

Here is a brand new signal tracer completely redesigned with compact dimensions and new circuit layout. Features built-in speaker and electron beam "eye" tube for signal indication and a unique noise locator circuit. Ideal for use in AM, FM and TV circuit investigation. RF and audio inputs are provided in one convenient probe with switch on probe to select either input. Useful for checking microphones, phone cartridges, record changers, tubers, etc. Makes a handy substitution speaker for servicing TV sets at the shop. Transformer operated for safety and high efficiency. Complete with test leads and informative construction manual. Shpg. Wt. 6 lbs.

RF SIGNAL GENERATOR KIT

Save valuable time in aligning RF tuned circuits of all kinds with this easy-to-use kit. Also a quick way to trace signals in faulty RF, IF and audio circuits. Designed for general service applications—the SG-8 covers 160 kc to 110 mc on fundamentals in five bands, and from 110 mc to 220 mc on calibrated harmonics. The entire oscillator circuit is built on a special sub-chassis, using prewound and calibrated coils. No further calibration is required so it is ready to use as soon as construction is completed. RF output is in excess of 100,000 microvolts, controlled by both step and continuously variable controls. Complete with output cable and instructions. Shpg. Wt. 8 lbs.

HEATH COMPANY • a subsidiary of Daystrom, Inc. • Benton Harbor 15, Mich.



Enjoy Rich 3 Dimension Sound...

Beautifully Styled with Plenty of Room for the Most Complete Stereo System

AVAILABLE IN THE FOLLOWING MODELS:
Model SE-1B—Stereo Equipment Cabinet (birch)
Model SE-1M—Stereo Equipment Cabinet (mahogany)

\$149⁹⁵
ea.

Model SC-1BR—Stereo Wing Speaker Enclosure (birch—right end)

Model SC-1BL—Stereo Wing Speaker Enclosure (birch—left end)

Model SC-1MR—Stereo Wing Speaker Enclosure (mahogany—right end)

Model SC-1ML—Stereo Wing Speaker Enclosure (mahogany—left end)

\$39⁹⁵
ea.



AVAILABLE AFTER JUNE 30

STEREO EQUIPMENT CABINET KIT

Imagine!... Stereophonic sound in your own home. This superbly designed cabinet holds all of your hi-fi stereo equipment and lends striking elegance to your living room. The attractive gold and black panels, trim and hardware brilliantly highlight the overall effect. Rich toned grille cloth, flecked in gold and black, complement the cabinet. The unit has ample room provided for an AM-FM tuner, tape deck, stereo pre-amplifier, amplifiers, record changer, record storage and speakers. Beautifully grained 1/4" solid core Philippine mahogany or select birch plywood is used for construction. The top features a shaped edge and sliding top panel for easy access to the stereo tape deck and stereo preamplifier. Sliding doors are employed for convenient front access to the

changer and record storage compartment. All parts of the cabinet are pre-cut and pre-drilled for simple assembly. The speaker wings and center cabinet may be purchased separately if desired. Note: the kit is delivered equipped with panels pre-cut to accommodate Heathkit components and also blank panels to cut out for your own equipment. Measurements of the individual component areas follow: tape deck and pre-amplifier area 20 3/4" L. x 17 3/4" W. x 10" D., record changer area 21" W. x 16" D. x 9 3/4" H., record storage area 22 3/4" W. x 14 1/2" H. x 12 1/2" D., speaker wing area (inside) 14" W. x 29 1/2" H. x 15 3/4" D., AM-FM Tuner area 20 1/2" W. x 5 1/4" H. x 14" D., amplifier (2 areas) 15 1/4" W. x 10 3/4" H. x 13 1/4" D.

Model HH-1B Birch
Model HH-1M Mahogany
Now only **\$299⁹⁵** each



**The Same Superior Performance
At a New Low Price**



HEATHKIT
SS-2 **\$39⁹⁵**

OPTIONAL LEGS
EXTRA

Economical Hi-Fi For Your Home

"LEGATO" HI-FI SPEAKER SYSTEM KIT

The increasing sales of the Legato has made more economical quantity production possible so we are passing the savings on to you by offering you this magnificent speaker system at a reduced price. Truly a "queen" among hi-fi speaker systems, the Legato was specially designed to meet and surpass the most stringent requirements of high fidelity sound reproduction. Two 15" Altec Lansing low frequency drivers cover frequencies of 25 to 500 CPS while a specially designed exponential horn with high frequency driver covers 500 to 20,000 CPS. A unique crossover network is built in making electronic crossovers unnecessary. Internal reflections are absorbed by splayed back panel and a 3" fiber glass lining. The Legato emphasizes simplicity of line and form to blend with modern or traditional furnishings. Cabinet construction is 3/4" veneer surface plywood in either African mahogany or white birch and measures 41" L. x 22 1/4" D. x 34" H. All parts are pre-cut and pre-drilled for easy assembly. Shpg. Wt. 195 lbs.

"BASIC RANGE" HI-FI SPEAKER SYSTEM KIT

True high fidelity performance at modest cost make this basic speaker system a spectacular buy for any hi-fi enthusiast. The amazing performance of this popular kit is made possible by the use of high quality speakers in an enclosure specially designed to receive them. The cabinet is a ducted port bass reflex type enclosure 11 1/2" H. x 23" W. x 11 1/4" D. It features an 8" mid range woofer to cover 50 to 1600 CPS and a compression-type tweeter with flared horn covering 1600 to 12,000 CPS. Both speakers are by Jensen. The adjustable flared tweeter horn allows speaker to be used in either upright or horizontal position. The cabinet is constructed of 1/2" veneer surfaced plywood suitable for light or dark finish of your choice. All wood parts are pre-cut and pre-drilled for easy assembly. Shpg. Wt. 25 lbs.

Attractive brass tip accessory legs convert SS-2 into attractive console. Legs screw into brackets provided. All hardware included. Shpg. Wt. 3 lbs. No. 91-26 \$4.95

with a Heathkit Stereo System



HIGH FIDELITY STEREO TAPE DECK KIT

For your unparalleled enjoyment in the world of stereophonic sound Heathkit brings you an all new stereo tape deck. This tape deck is a precision engineered instrument providing monaural record/playback, and stereo playback of prerecorded tapes. Incorporates three separate heads, erase-record-stereo playback (stacked). The mechanical tape deck assembly is supplied complete. You build only the record and playback circuit employing two etched circuit boards for ease of wiring. Low noise EF-86 tubes in input stages and efficient push-pull bias-erase oscillator insure complete freedom from hum and noise in recording and playback. Provision made for $3\frac{3}{4}$ and $7\frac{1}{2}$ IPS tape speed selected by a push button. Deck handles up to 7" reels of tape. Other features are: provision for monitoring tape while recording, built in VU meter for proper recording level, pause control for editing tape, "fast forward" and "rewind" control. Frequency response at $7\frac{1}{2}$ IPS tape speed is ± 2 db from 40 to 12,000 CPS, at $3\frac{3}{4}$ IPS speed 40 to 6,000 CPS. Signal-to-noise ratio is 55 decibels with less than 1% total harmonic distortion. NARTB tape playback equalization. A safety interlock button prevents accidentally switching to record position causing erasure of recorded tapes. Shpg. Wt. 33 lbs.

Model TR-1C monaural tape deck incorporates all of the features described for the model TR-1D with the exception of stereo playback. \$131.95.

No. C-TR-1C conversion kit converts model TR-1C to include stereo function of model TR-1D. \$15.95.



HEATHKIT
TR-1D

\$143⁹⁵

**Preassembled Tape Mechanism . . .
You Build Only Electronic Circuit**

AVAILABLE AFTER JUNE 30



HEATHKIT
SS-1B

\$99⁹⁵

**Fill out the Hi-Fi Range
of Your SS-2 Speaker**



HEATHKIT
SW-1

PRICE TO BE
ANNOUNCED

Save Time Rewinding Tape



HEATHKIT
TK-1

\$9⁹⁵

**All The Tools You Need For
Building Heathkits**

"RANGE EXTENDING" HI-FI SPEAKER SYSTEM KIT

This is not a complete speaker system in itself, but is designed to extend the range of the SS-2. The SS-1B uses a 15" woofer and a small super tweeter to supply the very high and very low frequencies to fill out the response of the basic SS-2. The SS-2 and SS-1B when used together, form an integrated four speaker system. The SS-2 and SS-1B combination provide an overall response of ± 5 db from 35 to 16,000 CPS. The kit includes circuit for crossover at 600, 1600 and 4,000 CPS. Impedance is 16 ohms and power rating is 35 watts. A control is also provided to limit output of super tweeter. The handsome cabinet measures 29" H. x 23" W. x 17 $\frac{1}{2}$ " D. Constructed of beautiful $\frac{3}{4}$ " veneer surface plywood. Complete step-by-step instructions make this kit easy to build. No wood-working experience required. Shpg. Wt. 80 lbs.

"SPEEDWINDER" KIT

This handy device leaves your tape recorder free for operation while it rewinds tape at the rate of 1200' in 40 seconds. Prevents unnecessary wear to the tape and recorder by eliminating wear against guides and heads. It will handle up to 10 $\frac{1}{2}$ " tape reels as well as 800' reels of 8 and 16 millimeter film. A very useful aid to operators of movie projection equipment. The Heathkit Speedwinder features an automatic shutoff which prevents whipping of tape when it has rewound. A manual shutoff is also provided. An automatic braking device is built in for protection against power failure. Driven by a heavy duty four pole motor. Handsome cabinet is constructed of furniture grade plywood. Step-by-step instructions are provided to make this kit easy to assemble even by one with no experience.

COMPLETE TOOL SET

A clear illustration of just how easy Heathkit building is. The pliers, diagonal sidecutters, two screw drivers and soldering iron are all the basic tools you need for building practically any Heathkit. Pliers and sidecutters are equipped with insulated rubber handles. The American Beauty soldering iron has a replaceable tip to facilitate cleaning. All the tools are of top quality case hardened steel for rugged duty and long life. With these simple, inexpensive tools in your hand you need not be afraid to tackle the most elaborate kit. The manual included with this handy kit provides you with many useful tips on the use and care of your tools. It shows the all important step of making proper solder connections. A truly worthwhile investment for the beginner in electronic kit building. Shpg. Wt. 3 lbs.

HEATH COMPANY • a subsidiary of Daystrom, Inc. • Benton Harbor 15, Mich.



Plan Your Hi-Fi System...

AVAILABLE AFTER JUNE 30



HEATHKIT
SP-2 \$56⁹⁵

Model SP-1 (monaural)
\$37.95

Model C-SP-1 (converts SP-1 to SP-2)
\$21.95

**Control both stereo
channels simply
and conveniently**

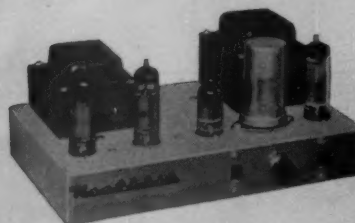
MONAURAL-STEREO PREAMPLIFIER KIT

This expertly designed preamplifier provides all the controls required for either standard monaural (single channel) or stereo (dual channel) sound reproduction. Features building block design... you can start with a basic preamplifier and add a second channel for stereo later on, without rewiring. Second channel plugs in for fast conversion. The complete model SP-2 (stereo) features twelve separate inputs, six on each channel with input level controls. Six dual-concentric controls consist of: two 8-position selector switches, two bass, two treble, two volume level and two loudness controls, a scratch filter switch and a 4-position function switch (separate on-off switch). The function switch provides settings for stereo, two-channel mix, channel A or B for monaural use. Inputs consist of tape, mike, mag phono and three high-level inputs. Tape input has NARTB equalization and input selector provides for RIAA, LP, 78 record compensation. EF86 tubes are used in the input stages along with hum balance controls to assure low hum and noise. Two cathode follower outputs with level controls provided in addition to two separate tape outputs for stereo recording. A remote balance control with twenty feet of cable allows balancing the stereo system from listening position. Construction is greatly simplified through the use of two printed circuit boards (one in each channel) and encapsulated printed circuits. The beautiful vinyl clad steel cover has leather texture in black with inlaid gold design. Built-in power supply.



HEATHKIT
WA-P2
\$19⁷⁵

**Finger-tip controls for
your operating convenience**



HEATHKIT
UA-1
\$21⁹⁵

**A low cost
versatile performer**

"MASTER CONTROL" PREAMPLIFIER KIT

Designed as a control center for basic amplifiers the WA-P2 provides you with true high fidelity performance for the finest audio systems. Fiveswitch-selected inputs accommodate a record changer, tape recorder, AM-FM tuner, TV receiver, microphone, etc., each with level control. Provision is also made for a tape recorder output. Ideal for "remote" installations, the WA-P2 features a low impedance cathode-follower output circuit allowing greater length of output lead. Full frequency response is obtained within $\pm 1\frac{1}{2}$ db from 15 to 35,000 CPS and will do full justice to the finest available program sources. Equalization is provided for records through separate turnover and rolloff switches for LP, RIAA, AES, and early 78's. A special hum balance control allows setting for minimum hum level. Power for operation is required from basic amplifier or external source. Shpg. Wt. 7 lbs.

"UNIVERSAL" 12-WATT AMPLIFIER KIT

A true high fidelity performer in every sense of the word, the UA-1 makes an ideal basic amplifier for any hi-fi system and is a perfect addition to gear your present hi-fi system for stereo sound. Uses 6BQ5/EL84 push-pull output tubes for less than 2% harmonic distortion throughout the entire audio range (20 to 20,000 CPS) at full 12 watt output. The on-off switch is located right on the chassis and an octal socket is provided for connecting a preamplifier for remote control operation. The specially designed output transformer provides excellent stability and frequency response. Taps for 4, 8 and 16 ohm speakers, with switched damping for "unity" or "maximum" on the 16-ohm tap. An input level control is provided for use in wired music systems where a preamplifier is not required. This versatile unit is the latest addition to the fine line of Heathkit basic amplifiers. Shpg. Wt. 13 lbs.

With Flexible Heathkit Components



DELUXE AM-FM TUNER KIT

Outstanding features in both styling and circuitry are combined in this 16-tube deluxe AM-FM combination tuner to bring you the very finest in program sources, for your listening enjoyment. Features include three circuit boards for easy construction and high stability—prewired, prealigned FM front end—built-in AM rod antenna—tuning meter—AFC (automatic frequency control) with on-off switch and flywheel tuning. AM and FM circuits are separate and individually tuned making it ideal for stereo applications. Cathode follower outputs with individual controls are provided for both AM and FM. Other features include variable AM bandwidth, 10 kc whistle filter, tuned-cascade FM front end, FM AGC and amplified AVC for AM. The unique IF limiter design automatically provides the number of limiting and IF stages required for smooth non-flutter reception. The silicon diode power supply is extremely conservatively rated and is fuse protected assuring long service life. A tuning meter shows when the station is tuned-in for clearest reception on AM or FM. Use of three circuit boards greatly simplifies construction of circuit, you do only a minimum of wiring. All IF transformers and coils are prealigned so it will be ready to operate as soon as construction is completed. Appearance of this top-quality unit is further enhanced by the vinyl-clad steel cover in black with inlaid gold design. A multiplex jack is provided for addition of converter unit to receive multiplex stereo broadcasts on FM. A top dollar value.

AVAILABLE AFTER JUNE 30



HEATHKIT
PT-1 \$89⁹⁵

**A deluxe AM-FM
tuner combination
loaded with extras!**



HEATHKIT
BC-1A
\$25⁹⁵

Wide range broadcast reception



HEATHKIT
FM-3A
\$25⁹⁵

Enjoy static-free FM entertainment

HIGH FIDELITY AM TUNER KIT

This AM tuner was designed especially for high fidelity applications. It incorporates a special detector using crystal diodes, and the IF circuit features broad bandwidth to assure low signal distortion. Audio response is ± 1 db from 20 CPS to 9 kc, with 5 db of pre-emphasis at 10 kc to compensate for station rolloff. Sensitivity and selectivity are excellent and the tuner covers the entire broadcast band from 550 to 1600 kc. Quiet performance is assured by a 6 db signal-to-noise ratio at 2.5 uv. Prealigned RF and IF coils eliminate the need for special alignment equipment. Incorporates AVC, two outputs, two antenna inputs, and built-in power supply. Edge-lighted glass slide rule dial for easy tuning. Your "best buy" in an AM tuner. Shpg. Wt. 9 lbs.

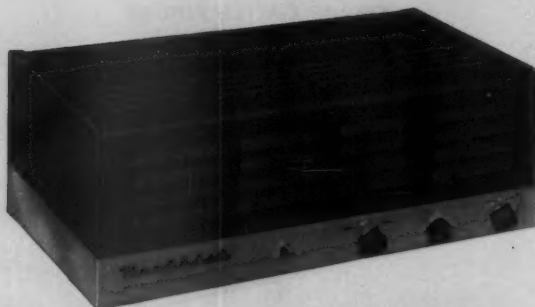
HIGH FIDELITY FM TUNER KIT

FM programming, your least expensive source of high fidelity will provide you with years of real enjoyment. This beautifully styled FM tuner features broad-banded circuits for full fidelity and better than 10 uv sensitivity for 20 db of quieting to pull in stations with clarity and full volume. Covers the complete FM band from 88 to 108 mc. Stabilized, temperature-compensated oscillator assures negligible drift after initial warmup. A ratio detector provides high-efficiency demodulation without sacrificing hi-fi performance. IF and ratio transformers are prealigned, as is the front end tuning unit, making special alignment equipment unnecessary. Edge-lighted glass slide rule dial for easy tuning. You need not wait to have FM in your home at this low price. Shpg. Wt. 8 lbs.

HEATH COMPANY • a subsidiary of Daystrom, Inc. • Benton Harbor 15, Mich.



You can be sure you're buying High Fidelity



HEATHKIT
W-7M

\$54⁹⁵

**55 watts of hi-fi power at
only \$1 per watt**

- ★ BEAUTIFULLY STYLED IN BLACK AND GOLD
- ★ UNITY OR MAXIMUM DAMPING

"EXTRA PERFORMANCE"

55 WATT HI-FI AMPLIFIER KIT

Another Heathkit first! An honestly rated high power amplifier with many top quality features at less than a dollar per watt. Full audio output is conservatively rated at 55 watts from 20 CPS to 20 kc with less than 2% total harmonic distortion throughout the entire range. Unique paired output connections permit instant switch selection of "unity" or "maximum" damping factors for all 4, 8 or 16 ohm speakers. Each output has an optimized current feedback circuit for unity damping so that there will be no compromise in performance when any of the impedances is used. This current feedback circuitry is entirely shorted out when not in use to obtain the highest possible damping factor. Features include level control and "on-off" switch right on the chassis plus provision for remote control from preamp, etc. Famous "bas-bal" circuit conveniently balances EL-34 output tubes. These heavy duty push-pull tubes operate into a high quality tapped-screen transformer designed especially for this unit. A 70-volt output on the transformer provides for P.A. or large music systems. The silicon diode power supply features a protection device that controls current until tubes have warmed up, greatly increasing service life of all components. The stylish black and gold case measures 6" H. x 8½" D. x 15" W. Convenient pilot light on the chassis. Thoughtful circuit layout makes this kit easy to build. Dollar for watt you can't beat this buy. Shipped express only. Shpg. Wt. 28 lbs.



HEATHKIT
W-6M

\$109⁹⁵

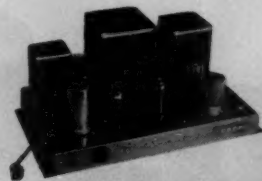
**Plenty of Reserve Power
Without Distortion**



HEATHKIT
W-5M

\$59⁷⁵

**Top-Flight Performance
for the Critical Listener**



HEATHKIT
W-4-AM

\$39⁷⁵

**Faithful Sound Reproduction
with Minimum Investment**

"HEAVY DUTY" 70-WATT HI-FI AMPLIFIER KIT

Here is an amplifier that will provide the extra "push" needed to drive any of the fine speaker systems available today, for truly fine performance at any power level. Silicon-diode rectifiers are used to assure long life and a heavy duty transformer gives you extremely good power supply regulation. Variable damping control provides optimum performance with any speaker system. Quick change plug selects 4, 8 and 16 ohms or 70 volt output and the correct feedback resistance. Frequency response at 1 watt is from 5 CPS to 80 kc with controlled HF rolloff above 100 kc. At 70 watts output harmonic distortion is below 2%, 20 to 20,000 CPS and IM distortion is below 1%, 60 and 6,000 CPS. Hum and noise 88 db below full output. Metered balance circuit. Designed especially for easy assembly and years of dependable service. Shipped express only. Shpg. Wt. 52 lbs.

25-WATT HI-FI AMPLIFIER KIT

Considered top value in its power class by leading independent research organizations, the W-5M incorporates all the design features required by the super critical listener. Features include a specially designed Peerless output transformer and KT66 tubes. The circuit is rated at 25 watts and will follow instantaneous power peaks of a full orchestra up to 42 watts. A "tweeter saver" suppresses high frequency oscillation and a new type balancing circuit facilitates adjustment of the "dynamic" balance between output tubes. Frequency response is ± 1 db from 5 CPS to 160,000 CPS at 1 watt and within 2 db from 20 to 20,000 CPS at full 25 watts output. Harmonic distortion is less than 1%, at 25 watts and IM distortion is 1% at 20 watts (60 and 3,000 CPS, 4:1). Hum and noise are 99 db below 25 watts for truly quiet performance. Rich black and gold colored styling. Shipped express only. Shpg. Wt. 31 lbs.

20-WATT HI-FI AMPLIFIER KIT

This fine amplifier will amaze you with its outstanding performance. It features a true Williamson circuit with extended frequency response, low distortion, and low hum levels. Enjoy true hi-fi with only a minimum investment compared to other units on the market. 5881 tubes and a special Chicago-Standard output transformer are employed to give you full fidelity at minimum cost. Frequency response extends from 10 CPS to 100 kc within ± 1 db at 1 watt assuring you of full coverage of the audio range. Clean, clear sound amplification takes place in circuits that hold harmonic distortion at 1.5% and IM distortion below 2.7% at full 20 watt output. Hum and noise are 95 db below full output. Taps on the output transformer are at 4, 8 or 16 ohms to match the speaker system of your choice. An outstanding performer, this investment will bring you years of listening enjoyment. Shipped express only. Shpg. Wt. 28 lbs.

All basic amplifiers recommended for use with model WA-P2, SP-1 or SP-2 preamplifiers

...When You Buy Heathkits



"BOOKSHELF" 12-WATT AMPLIFIER KIT

The model EA-2 combines eye-pleasing style and color with many extra features for high quality sound reproduction. This fine amplifier provides full range frequency response from 20 to 20,000 CPS within ± 1 db. Harmonic distortion is less than 1% at full 12 watt output over the entire range (20-20,000 CPS). IM distortion is less than 1.5% at 12 watts with low hum and noise. Miniature tubes are used throughout the advanced circuitry, including **6X4** output tubes in a push-pull tapped-screen output circuit using a special designed output transformer. Transformer has taps at 4, 8 and 16 ohms. The model EA-2 has its own built-in preamplifier with provision for three separate inputs, mag phono, crystal phono and tuner. The mag phono input features RIAA equalization. Separate bass and treble controls are provided with boost and cut action. A special hum-balance control assures quiet operation. The luxury styled cabinet has a smooth simulated leather texture in black with inlaid gold design and is constructed of vinyl plastic bonded to steel. It resists scuffing, wear, abrasion, and chemicals. The front panel features brushed-gold trim and buff knobs with gold inserts for a very pleasing appearance. An amber neon pilot lamp indicates when the amplifier is on. Cabinet measures $12\frac{1}{2}$ " W. x $3\frac{3}{16}$ " D. x $4\frac{3}{4}$ " H. making it suitable for use on a bookshelf, end table, etc. High quality is emphasized throughout for performance matching amplifiers costing many times more. Shpg. Wt. 15 lbs.

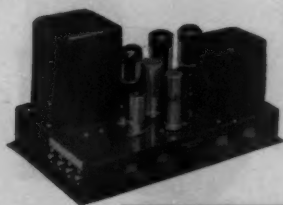


HEATHKIT
EA-2

\$27⁹⁵

**Combines beauty, style
and quality**

- ★ LESS THAN 1% DISTORTION AT FULL OUTPUT OVER ENTIRE AUDIO RANGE.
- ★ BUILT-IN PREAMPLIFIER



HEATHKIT
A9-C

\$35⁵⁰

**A Bargain Package of
Power and Performance**



HEATHKIT
AV-3

\$29⁹⁵

**Invaluable for
Hi-Fi Testing**



HEATHKIT
AW-1

\$29⁵⁰

**Measure Exact
Power Output**

GENERAL-PURPOSE 20-WATT AMPLIFIER KIT

The A9-C combines a preamplifier, main amplifier and power supply all on one chassis providing a compact unit to fill the need for a good high fidelity amplifier with a moderate cash investment. Designed primarily for home installations, it is also capable of fulfilling P.A. requirements. The preamplifier section features four separate switch selected inputs. Separate bass and treble tone controls offer 15 db boost and cut. A true high fidelity performer, the A9-C covers 20 to 20,000 CPS within ± 1 db. Front panel is detachable, and can be installed on the outside of a cabinet where the chassis comes through, for custom installations. A fine unit with which to start your hi-fi system. Shpg. Wt. 23 lbs.

AUDIO VTVM KIT

Critical AC voltage measurements are made easy with this high quality vacuum tube voltmeter which emphasizes stability, broad frequency response and sensitivity. Features large $4\frac{1}{2}$ " 200 microampere meter, with increased damping in the meter circuit for stability in low frequency tests. Extremely high voltage range handles measurements from a low value of 1 millivolt to a maximum of 300 volts. AC (RMS) voltage ranges are: 0-.01, .03, .1, .3, 1, 3, 10, 30, 100 and 300 volts. Db ranges cover -52 to $+52$ db. Employs 1% precision multiplier resistors for maximum accuracy. High input impedance (1 megohm at 1,000 CPS). Frequency response is essentially flat from 10 CPS to 200 kc. Shpg. Wt. 6 lbs.

AUDIO WATTMETER KIT

Here is a fine meter to accurately measure output wattage. Five power ranges cover 0-5 mw, 50 mw, 500 mw, 5 w and 50 w full scale. Five switch selected db ranges cover -10 db to $+30$ db. All indications are read directly on the large $4\frac{1}{2}$ " 200 ua meter. Frequency response is ± 1 db from 10 CPS to 250 kc. External or internal load resistors are selected with convenient front panel switch. Non-inductive load resistors are built in for 4, 8, 16 or 600 ohms impedance. Precision multiplier resistors are used for high accuracy and incorporates a crystal diode bridge for wide-range frequency response. Modern styling and convenient front panel design. Cabinet is ventilated to allow efficient cooling of load resistors. Shpg. Wt. 7 lbs.

HEATH COMPANY • a subsidiary of Daystrom, Inc. • Benton Harbor 15, Mich.



Easy to Buy - Easy to Build - Easy to Use...

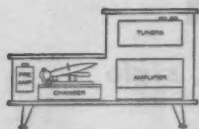


CONTEMPORARY
Model CE-1B Birch
Model CE-1M Mahogany

HEATHKIT
CE-1
\$43⁹⁵
each



TRADITIONAL
Model CE-1T Mahogany



**Combine all your Hi-Fi equipment
in this attractive cabinet**

CHAIRSIDE ENCLOSURE KIT

This Chairside Enclosure lets you combine all of your hi-fi equipment into one compact control center and, at the same time add a beautiful piece of furniture to your home. The CE-1 is designed to house the AM and FM tuners (BC-1A and FM-3A) and the WA-P2 preamplifier along with the majority of record changers which will fit into the space provided. Adequate room is available in the rear of the unit to house any of the Heathkit amplifiers designed to operate with the WA-P2. The enclosure is flexible enough to give you a large choice in component installation. If only one tuner and the preamplifier are used, the two units can be installed in the tilt-out drawer, or if more convenient, either unit can be placed in the space provided in front of the changer compartment. The tilt-out shelf can be installed on either right or left side and the lift-top lid is similarly designed to lift from either side depending on your choice during construction. Good ventilation is achieved through appropriately placed slots in the bottom and back of the enclosure. Overall dimensions are 18" W. x 24" H. x 35½" D. The changer compartment measures 17¼" L. x 16" W. x 9½" D. All parts are precut and predrilled for easy assembly and attractive hardware is supplied to match each style. The contemporary cabinet is available in either mahogany or birch and the traditional cabinet is available in mahogany only. Furniture grade plywood can be finished to your taste. Shpg. Wt. 46 lbs.



HEATHKIT
AG-9A
\$34⁵⁰

**Your own source of
Hi-Fi audio signals**



HEATHKIT
AA-1
\$49⁹⁵

**3 Audio test instruments
in one compact unit**



HEATHKIT
HD-1
\$49⁵⁰

**Check amplifier
distortion quickly**

AUDIO SIGNAL GENERATOR KIT

The model AG-9A is "made to order" for high fidelity applications, and provides quick and accurate selection of low-distortion signals from 10 CPS to 100 kc. Three rotary switches select two significant figures and a multiplier to determine audio frequency. Incorporates step-type and a continuously variable output attenuator. Output indicated on large 4½" panel meter, calibrated in volts and db. Attenuator system operates in 10 db steps, corresponding to meter calibration, in ranges of 0-.003, .01, .03, .1, .3, 1, 3 and 10 volts RMS. "Load" switch permits use of built-in 600-ohm load, or external load of different impedance. Output and frequency indicators accurate to within ± 5%. Distortion less than .1 of 1% between 20 and 20,000 CPS. Shpg. Wt. 8 lbs.

AUDIO ANALYZER KIT

Complete high fidelity testing facilities are yours in the AA-1. It combines the functions of three separate instruments; an AC VTVM, audio wattmeter and a complete IM analyzer with filters and high and low frequency oscillators built in. VTVM ranges are: 0-.01, .03, .1, .3, 1, 3, 10, 30, 100 and 300 volts (RMS). Db scale reads from -65 to +52 dbm. Wattmeter ranges are: .15 mw, 1.5 mw, 15 mw, 150 mw, 1.5 w, 15 w and 150 w. IM scales are 1%, 3%, 10%, 30% and 100% full scale. Provides internal load resistors of 4, 8, 16 or 600 ohms. Combining and consolidating functions reduces the number of test leads and controls required for the same test. Complete instructions are provided for easy assembly, also valuable information on use of instrument. Shpg. Wt. 13 lbs.

HARMONIC DISTORTION METER KIT

Valuable in both designing and servicing of audio circuits, the HD-1 used with an audio signal generator, will accurately measure harmonic distortion at any or all frequencies between 20 and 20,000 CPS. Distortion is read on panel meter in ranges of 0-1, 3, 10, 30 and 100% full scale. Full scale voltage ranges of 0-1, 3, 10 and 30 volts are provided for the initial reference settings. Signal-to-noise ratio is measured on a separate meter scale calibrated in db. Features high input impedance (300,000 ohms) and 1% precision resistors in the VTVM voltage divider circuit for excellent sensitivity and accuracy. High quality components insure years of dependable service. Complete instructions provided for easy assembly and operation. Shpg. Wt. 13 lbs.

Heathkits are Your Best Dollar Value



TRANSISTOR PORTABLE RADIO KIT

The overwhelming sales of this outstanding transistor portable have made a substantial price reduction possible... in addition, an all new plastic molded case adds the finishing touch to the exceptional circuitry. Six name-brand (Texas Instrument) transistors are used for extra good sensitivity and selectivity. The 4" x 6" PM speaker with heavy magnet provides excellent tone quality. Use of this large speaker and roomy chassis make it unnecessary to crowd components adding greatly to the ease of construction. Transformers are prealigned so it is ready for service as soon as construction is completed. A touchup in alignment is easily accomplished on a station by following simple instructions in manual. Alignment tool furnished. Has built-in rod-type antenna for reception in all locations. Six standard size "D" flashlight cells are used for extremely long battery life (between 500 and 1000 hours) and they can be purchased almost anywhere. Cabinet is two-tone blue molded plastic with pull-out carrying handle. Dimensions are 9½" L. x 7¼" H. x 4" D. Shpg. Wt. 6 lbs.

Model XR-1-L: Identical to XR-1-P except in genuine leather case. Rich, warm sun-tan tone. Leather carrying strap included. Shpg. Wt. 7 lbs.

Leather Case: can be purchased separately if desired. Fits all XR-1-P's and XR-1's. No. 93-1. Shpg. Wt. 3 lbs. \$6.95.



MODEL XR-1-L
\$34.95

HEATHKIT
XR-1-P

\$29.95

Newly designed plastic case... new low price!

- ★ 4" X 6" SPEAKER FOR "BIG SET" TONE
- ★ LONG BATTERY LIFE (500 to 1000 Hours)



HEATHKIT
CT-1
\$7.95

Test condensers right in the circuit



HEATHKIT
DF-1
\$54.95

Pin-point your exact location



HEATHKIT
FD-1
\$35.95 each
(6 volt model FD-1-6)
(12 volt model FD-1-12)

Detects gas fumes



HEATHKIT
MC-1
\$42.95

Save your boat batteries

IN-CIRCUIT CAPACI-TESTER KIT

Check most capacitors for "open" or "short" right in the circuit with this handy kit. Detects open capacitors from about 50 mfd up, not shunted by an excessively low resistance value. Checks shorted capacitors up to 20 mfd (not shunted by less than 10 ohms). (Does not detect leakage nor check electrolytic condensers.) Employs a 60-cycle frequency for the short test and a 19 megacycle frequency for the open test. Uses electron beam "eye" tube for quick indication. Test leads included. Shpg. Wt. 5 lbs.

TRANSISTOR RADIO DIRECTION FINDER KIT

This transistor radio compass will double as a portable radio. Covers the standard broadcast band from 540 to 1600 kc. Ideal for use aboard boats and also on land by hunters, hikers, etc. A directional high-Q ferrite antenna rotates from the front panel to obtain a fix on a station. A 1 ma meter serves as null and tuning indicator. Prealigned IF transformers—six transistor circuit. Powered by tiny 9-volt battery with spare included. Dimensions 7½" W. x 5¼" H. x 5¼" D. Shpg. Wt. 5 lbs.

FUEL VAPOR DETECTOR KIT

Protect your boat and passengers against fire and explosion with one of these fuel vapor detector kits. Indicates the presence of fumes on a three-color "safe-dangerous" meter scale and immediately shows if it is safe to start the engine. A pilot lamp shows when the detector is operating. Easy to build and install, even by one not having previous experience. Operates from your boat battery. The kit is complete with heavy-duty neoprene insulated cable and includes spare detector unit. Shpg. Wt. 4 lbs.

MARINE CONVERTER KIT

Charge 6 or 12 volt batteries with this marine converter and battery charger. A panel mounted 25 ampere meter continuously monitors the charging current. Moisture and fungus proofed for rugged marine use. Convection cooling prevents unsafe temperature rise. The MC-1 has no moving parts, tubes nor blowers to wear out or break. Mounting brackets are supplied for easy installation on any boat. Ideal for keeping batteries fully charged or to supply extra current for appliances. Shpg. Wt. 16 lbs.

HEATH COMPANY • a subsidiary of Daystrom, Inc. • Benton Harbor 15, Mich.



New Styling - New Features...



HEATHKIT
TX-1 \$229⁵⁰

Complete Versatility for Top- Notch Amateur Communications

- ★ NEWLY DESIGNED VFO—ROTATING SLIDE RULE DIAL
- ★ MODERN STYLING—PROVISION FOR SSB ADAPTER

"APACHE" HAM TRANSMITTER KIT

Fresh out of the Heath Company laboratories, the brand-new "Apache" model TX-1 ham transmitter features modern styling and the latest in circuitry for extra fine performance. The "Apache" is a high quality transmitter operating with a 150 watt phone input and 180 watt CW input. In addition to CW and phone operation, built-in switch selected circuitry provides for single-sideband transmission through the use of a plug-in external adapter. These SSB adapters will be available in the near future. A compact, stable and completely redesigned VFO provides low drift frequency control necessary for SSB transmission. A slide rule type illuminated rotating VFO dial with vernier tuning provides ample bandspread and precise frequency settings. The bandswitch allows quick selection of the amateur bands on 80, 40, 20, 15 and 10 meters. (11M with crystal control). This unit also has adjustable low level speech clipping and a low distortion modulator stage employing two of the new 6CA7/EL-34 tubes in push-pull class AB operation. Time sequence keying is provided for "chirpless" break-in CW operation. The final amplifier is completely shielded for greater TVI protection and transmitter stability. Die-cast aluminum knobs and front panel escutcheons add to the attractive styling of the transmitter. Pi network output coupling matches antenna impedances between 50 and 72 ohms. Shpg. Wt. 115 lbs.

\$50.00 deposit required on C.O.D. orders. Shipped motor freight unless otherwise specified.



HEATHKIT
DX-20 \$35⁹⁵

**An Ideal
Code Transmitter**



HEATHKIT
DX-100 \$189⁵⁰

**You'll be Proud to Own
This Outstanding Performer**



HEATHKIT
DX-40 \$64⁹⁵

**Phone & CW Facilities
at Low Cost**

DX-20 CW TRANSMITTER KIT

Designed especially for CW work, the DX-20 features high efficiency at low cost. An ideal rig for the novice or advanced-class CW operator. Plate power input is 50 watts, and covers 80, 40, 20, 15, 11 and 10 meters with single knob band-switching. Features a single 6DQ6A tube in the final amplifier stage and a 6CL6 as a crystal oscillator. Pi network output circuit matches various antenna impedances between 50 and 1000 ohms and reduces harmonic output. Top-quality parts are featured throughout, including "potted" transformers, etc., for long service life. Complete shielding to minimize TVI. Removable metal pull-out plug on left end of cabinet provides access for crystal changing. Very easy to build with complete instructions supplied. Shpg. Wt. 19 lbs.

DX-100 PHONE AND CW TRANSMITTER KIT

Well known for its high quality and fine performance the DX-100 features a built-in VFO, modulator, and power supply, complete shielding to minimize TVI, and a pi network coupling to match impedances from 50 to 600 ohms. RF output is in excess of 100 watts on phone and 120 watts on CW, for clean strong signals on all ham bands from 10 to 160 meters. Single knob bandswitching and illuminated VFO dial and meter face add real operating convenience. RF output stage uses a pair of 6146 tubes in parallel, modulated by a pair of 1625's. High quality components are used throughout, such as potted transformers, silver-plated or solid coin silver switch terminals, aluminum-heat dissipating caps on the final tubes, copper plated chassis, etc. Shpg. Wt. 107 lbs.

\$50.00 deposit required on C.O.D. orders. Shipped motor freight unless otherwise specified.

DX-40 PHONE AND CW TRANSMITTER KIT

An outstanding buy in its power class the DX-40 provides both phone and CW operation on 80, 40, 20, 15, 11 and 10 meters. A single 6146 tube is used in the final amplifier stage to provide full 75 watt plate power input on CW, or controlled carrier modulation peaks up to 60 watts for phone operation. Modulator and power supplies are built in and single-knob bandswitching is combined with the pi network output circuit for complete operating convenience. Complete shielding to minimize TVI. Provision is made for three crystals. A four-position switch selects any of the three crystals or a jack for external VFO. Crystal sockets are reached through access door in rear of cabinet. High quality D'Arsonval movement panel meter. Shpg. Wt. 25 lbs.

For Real Ham Enjoyment



"MOHAWK" HAM RECEIVER KIT

Here is a ham receiver that any radio operator would be proud to own. The "Mohawk" has all the functions required for high quality communications with clear, rock-steady reception on all bands. This 15-tube receiver features double conversion with IF's at 1682 kc and 50 kc and covers all of the amateur frequencies from 160 through 10 meters on seven bands with an extra band calibrated to cover 6 and 2 meters using a converter. Receiver accommodations are provided for these converters which will be available in Heathkits soon. The "Mohawk" is specially designed for single-sideband reception with crystal controlled oscillators for upper and lower sideband selection. A completely preassembled, wired and aligned front end coil assembly assures ease of construction and top performance of the finished unit. Other features include five selectivity positions from 5 kc to 500 CPS, bridged T-notch filter for maximum heterodyne rejection, and a built-in 100 kc crystal calibrator. The set provides a 10 db signal-to-noise ratio at less than 1 microvolt input. Front panel features S meter, separate RF, IF and AF gain controls, T-notch tuning, T-notch depth, ANL, AVC, BFO, bandswitch, tuning, antenna trimmer, calibrate set, calibrate on, CW-SSB-AM, receive-standby, upper-lower sideband, selectivity, phone jack and a wide band rotating slide rule type vernier tuning dial with easy to read calibrations. Shpg. Wt. 90 lbs. \$50.00 required on C.O.D. orders. Shipped motor freight unless otherwise specified.

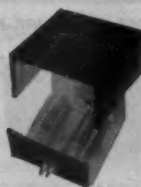


HEATHKIT
RX-1

\$274⁹⁵

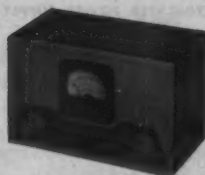
Now in Kit Form a Top Quality Ham Band Receiver

- ★ PREWIRED AND ALIGNED FRONT END COIL ASSEMBLY.
- ★ CRYSTAL CONTROLLED OSCILLATORS FOR DRIFT-FREE RECEPTION.



HEATHKIT
B-1 **\$8⁹⁵**

**Get Proper Match
Between Transmitter
and Antenna**



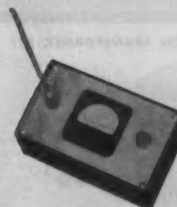
HEATHKIT
AM-2 **\$15⁹⁵**

**Measure Standing
Wave Ratio**



HEATHKIT
VX-1 **\$23⁹⁵**

**Eliminates Hand
Switching**



HEATHKIT
PM-1 **\$14⁹⁵**

**Quick Check of
Transmitter Operation**

BALUN COIL KIT

Unbalanced coax lines used on the most modern transmitters can be matched to balance lines of either 75 or 300 ohms impedance by using the model B-1 Balun Coil Kit. Can be used with transmitters and receivers without adjustment over the frequency range of 80 through 10 meters, and will handle power inputs up to 200 watts. Cabinet size is 10" square by 5" D. and may be located any distance from the transmitter or antenna. A protective cover is supplied to prevent damage in outdoor installations. Shpg. Wt. 4 lbs.

REFLECTED POWER METER KIT

The match of your antenna transmission system can be checked by measuring the forward and reflected power or standing wave ratio from 1:1 to 6:1 with this fine unit. Designed to handle a peak power of well over 1 kilowatt of energy the AM-2 may be left in the antenna system feed line at all times. Band coverage is 160 meters through 2 meters. Input and output impedances for 50 or 75 ohm lines. No external power required for operation. Cabinet size is 7 1/4" x 4 1/2" x 4 1/2". Shpg. Wt. 3 lbs.

ELECTRONIC VOICE CONTROL KIT

This unique device allows you to switch from receiver to transmitter merely by talking into your microphone... you get the advantage of "telephone-type conversation" as in single sideband but with regular AM transmission. The unit is adjustable to all conditions by sensitivity controls provided. A variable time delay control changes the "hold" time. Provision is made for receiver and speaker connections and also for a 117 volt antenna relay. Built-in power supply. Complete instructions provided. Shpg. Wt. 5 lbs.

RF POWER METER KIT

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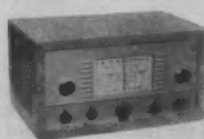
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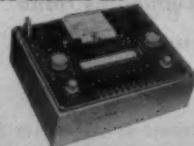
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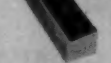
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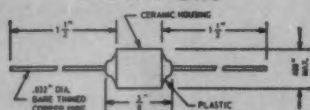


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MAX. PEAK INVERSE VOLTAGE	400	360
MAX. PEAK CURRENT (MA)	7500	2000
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APPROX. RECTIFIER VOLTAGE DROP	2	2
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New CRT in Philco TV

(Continued from page 50)

also had to be reconsidered. The result is a coil assembly that is wound to maintain high deflection efficiency with no sacrifice in over-all focus. Most important, this change involved no great cost increase.

As with the yoke, it was important that the picture tube could be produced at a price competitive with existing types. This was achieved despite the fact that the method of evacuating and sealing the CRT had to be altered. With conventional techniques, this operation would damage the heater-cathode assembly, which is quite close to the base of the *SF* tube.

With the tube and yoke out of the way, the rest of the job involving the set itself would appear to be largely out of the hands of the electronics department. This was true to a great extent, but not entirely. The 17-inch portable segment of the 1959 *Philco* line consists of handle-on-the-top receivers styled along the lines of the common briefcase. Contributing to the slender appearance is the "wrap-around" chassis, which is contoured about the *SF* tube and adds nothing to the depth of the housing itself.

For the larger, non-portable receivers, chassis layout is somewhat more conventional, but the external appearance of many of them is unusual. The CRT is in a separate housing made of high-impact plastic, transparent over the viewing area, and appearing to have been molded around the picture tube. This housing swivels, much in the manner of certain vanity mirrors, so that it can be adjusted to the most convenient viewing position. Chassis and operating controls are built into a separate compact cabinet, available as a table-top unit, on legs in a lowboy style, or in an upright "pedestal" model. In each case, the CRT housing is mounted on top of the cabinet.

In one variation shown on page 50, the receiver connects to the picture-tube housing through a 25-foot, multi-conductor cable. This permits flexible placement of the CRT about the room away from the chassis. Since signal, second-anode, filament, deflection, and other voltages must all be carried in this cable, adequate insulation as well as shielding to prevent cross-talk had to be worked out carefully. Both cable and CRT housing meet *UL* requirements.

A video signal fed directly through such a cable would deteriorate seriously, so once more the electronics men stepped into the picture. A low-impedance cathode follower at the main chassis feeds the signal through the cable to a video-driver tube mounted near the neck of the CRT. This, in turn, feeds the picture tube.

As for receiver circuit design, *Philco's* 1959 line involves no radical changes, closely resembling its 1958 line.

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RADIO & TV NEWS



Army MARS Net Resumes Technical Broadcasts

*New series for hams uses
SSB to teach by radio.*

THE First Army Military Affiliate Radio System (MARS) Technical Net will resume operation with the first of its new series of technical symposia for amateur radio operators. The net operates on single-sideband (upper sideband) on 4030 kc. each Wednesday evening at 9 p.m. (EDT), beginning September 3rd.

Selected speakers from the electronic and communication field will give talks followed by a question and answer session. Stations will call in from all parts of the first and second amateur call areas in the northeastern United States. Orderly radiotelephone procedure will be used.

Ed Pillar, W2KPKQ, of Whitestone, Long Island, who is the technical director and net control station, said that, based on past experience, the talks should be heard within a radius of 1000 miles of New York City on most of the evenings. John Novak, K2KUC, of Clifton, New Jersey, is the alternate net control station.

The net has made use of tapes and long-distance phone patches to get outstanding speakers from various parts of the country. Live talks have already originated from five of the member stations.

Speakers for the month of September have been scheduled as follows:

Sept. 3—"Fifty Years of Reminiscence in Radio" by Emil J. Simon, Electronic Engineer and Consultant (Former Assistant to Lee De Forest).

Sept. 10—"Features of Modern Amateur SSB Equipment" by Ernest W. Pappenfus, Engineering Dept. Head, Collins Radio Company.

Sept. 17—"Applications of Incredible High Frequency Saturable Reactors" by Carl G. Sontheimer, Executive Vice-Pres. and Herbert F. Spier, Ass't. Chief Engineer, CGS Laboratories, Inc.

Sept. 24—"Auditory Test Equipment for the Blind Radio Amateur and Technician" by Robert Gunderson, W2JIO, Editor, Braille Technical Press.

September, 1958

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SPECIFICATIONS

VERTICAL CHANNEL—3 stage push-pull
SENSITIVITY: DC—70 mv/in.
AC—25 mv RMS/in.

FREQ. RESPONSE:

DC—Within 3 db to 4.5 Mc.
Within 5 db to 5 Mc.
AC—Within 3 db from 1 cps to 4.5 Mc.
Within 5 db to 5 Mc.

RISE TIME: Better than .06 microseconds
INPUT IMPEDANCE: 1.5 megohms shunted by 33 mmfd
VERTICAL-INPUT STEP ATTENUATOR
VERTICAL POLARITY REVERSAL SWITCH

HORIZONTAL CHANNEL—push-pull output
SENSITIVITY: 0.6 v RMS/in.

FREQ. RESPONSE: Within 3 db from 1 cps to 400 Kc
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CATHODE-FOLLOWER HORIZONTAL INPUT CIRCUIT
LINEAR TIME BASE: 10 cps to 100 Kc, TV-V and TV-H, plus provisions for external capacitor sweep to 1 cps. Automatic "positive" and "negative" synchronization.

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MODEL S-55: Complete with all tubes including CRT, PACO-detailed assembly-operating manual, in louvred steel cabinet with two-color, easy-reading panel. Size: 13 3/4" x 8 3/4" x 17 1/4".
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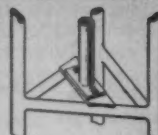
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Service Association of the Month



ELECTRONIC SERVICE ASSOCIATION OF DETROIT

DETROIT'S ESA is not the only group of this kind in its area. Also highly active in the region is the Television Service Association of Michigan, which many readers will recall as being mentioned in our June editorial on licensing in action.

The call for unity in the service industry is certainly a worthwhile one, but we are likely to hear the cry repeated for many years before that unity becomes a fact. Perhaps, as long as there are honest differences in approach to the problems that confront service people, it is better to have separate instruments through which these differences can be expressed and possibly worked out, than to have arbitrary and uneasy unity. In any case, Michigan is one of several portions of this nation in which there is no single voice to speak for service.

Launched in 1954, the Electronic Service Association, based at 15951 Tuller, Detroit, has 39 members. These are all in TV service and pledged to abide by the ESA code of ethics.

Officers, elected annually in April, include Joseph Rosson, president; Arthur Shaul, vice-president; Dale Brock, recording secretary; and Howard Larsen, treasurer and corresponding secretary. Meetings are held on the first and third Wednesdays of each month. Once affiliated with AMETA, a state-wide group, ESA now stands alone, although it has worked with other groups.

Of particular interest to the industry as a whole is the ESA stand on licensing. Although it has more reservations with respect to existing legislation in Detroit than have been expressed in other quarters, this organization has not dedicated itself to wiping the law off the books. In fact, it proudly points out that its past president, Ralph

Carew, is currently a member of the licensing board, and it claims some of the credit in getting the legislation passed. However, it points to weaknesses in the present arrangement for licensing.

For one thing, it feels that the principle involved, if it is sound, is not one that should have unique application to TV service alone. Any person involved with the repair or service of equipment of all kinds should also be licensed. Also included, ESA feels, should be such groups as auto mechanics, watchmakers, appliance repair men, and others. The present legislation requiring licensing for TV technicians therefore tends to be discriminatory because one industry has been singled out, and also because fees are not equitable. For example, a plumber in Michigan may take out a state license for \$5.00, whereas a TV technician must pay \$10.00. A plumbing contractor must pay \$15.00, whereas a TV service dealer must part with \$25.00.

Also of concern to ESA is its feeling that the licensing law, as it stands, tends to favor certain large service establishments. In the latter, certain supervisory personnel are considered to be responsible and therefore subject to licensing, but others are exempted. In a specific case, the RCA Service Co. is reported to have 82 men in the area, only two of whom are licensed.

Most prosecutions under the law have been for failure to obtain licenses. This has brought several thousands of dollars into the city's general fund. ESA hopes that this significant source of revenue will not result in the law becoming an instrument for raising money rather than a device for justice. It feels that the law should be retained, but improved with experience to insure justice.

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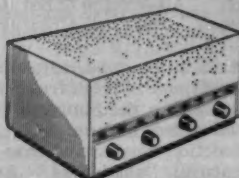


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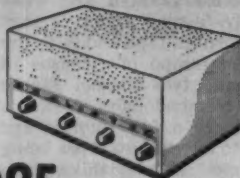
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Sound on Tape

By BERT WHYTE

IF YOU saw the Editor's Note in last month's column, you know that RCA has released the 3 1/4 ips, four-channel long-play stereo magazine form of recorded tape with machines on which to play these cartridges due in October. As of the moment I haven't heard any of them, but I have been hearing plenty about the impact of these little magazine tapes. There are squawks loud and long from folks who recently purchased equipment to play the conventional two-track, 7 1/2 ips stereo tapes. They are quite disturbed over the early obsolescence of their equipment and say so in language not suitable for inclusion on these pages!

I have tried to placate some of them by pointing out that, sooner or later, the manufacturers of their particular units will be putting out conversion kits, so that at least they can play the reel form of the four-channel stuff. Oddly enough, I find that most of them take this idea for granted and what they are really burned about is that with this new form of tape and with the stereo disc, the tempo of releases in the conventional two-channel stereo has fallen off tremendously. And this is so true. Where a few months ago there were 40 to 50 or more tapes being released each month, today this stream has dried up to a mere trickle. Obviously the manufacturers are just riding with the tide, waiting to see which way the ball is going to bounce and they are not committing themselves to anything more than token releases. It does no good to point out how many thousands of conventional machines are on the market with their potential of sales undiminished. I suppose it's just human nature and the grass always looks greener on the other side.

Things are as they are and until the statistics are in on the stereo disc and the magazine tape after some months of operation, I'm afraid the drought in the present form of stereo tape will continue. My one suggestion is to look back through the stereo tape catalogue and you will find many early items which are quite good and which you may have overlooked. Victor's very first tape, for instance, Richard Strauss' "Also Sprach Zarathustra" is still one of the best and most spectacular stereo tapes ever issued and there are others in like category. Other than that the only encouragement I can offer is my opinion that when everything gets sorted out, you will find a full-scale resump-

tion of releases in the conventional format. I've heard enough stereo in alternative forms to know this... the 7 1/2 ips, two-channel tape may well have a substantial edge in quality and there will always be enough quality-conscious and discerning people to constitute a healthy market for this type of recording.

A MIGHTY FORTRESS

The Robert Shaw Chorale conducted by Robert Shaw. Victor ACS-107. Price \$6.95.

Few types of music are as effective in the stereo format as a good sized chorus. When you have one of the excellence of the Robert Shaw group, singing five of the best known hymns, the over-all sonic impression is quite thrilling. The chorus, bringing fabulous breath control and phrasing to a new high, sings with admirable fervor such staples as "A Mighty Fortress," "Fairest Lord Jesus," "Prayer of Thanksgiving," "All People That On Earth Do Dwell," and "All Creatures of Our God and King."

The sound is quite good, affording fine stereo directional effects from the various choirs within the chorus. The center is well filled and in spite of the good direction the sound has a pleasingly natural "wholeness." Dynamic range was fairly wide and, at a good room-filling level, tape hiss was not obtrusive. My only quibble here is that on some of the selections there appeared to have been an attempt to use middle-range equalization in order to give the voices more "presence." I feel that this is a mistake as the stereo affords enough liveness and any equalizer tampering becomes quite prominent and detracts rather than adds to "naturalness." It is quite possible that this effect will not be noticed on many loudspeakers. In any case it is not serious enough to negate the general attractiveness of the tape for anyone who likes good hymns well done by a crackerjack chorus.

CROFÉ

GRAND CANYON SUITE MISSISSIPPI SUITE

Hollywood Bowl Symphony Orchestra conducted by Felix Slatkin. Capitol ZF-53. Price \$12.95.

This is the second stereo version of the "Grand Canyon Suite" and the first time for the lesser-known "Mississippi Suite." The "Canyon" faces a formidable rival in the recording by the Boston Pops on a Victor tape. A listen to both of them convinces me of

RADIO & TV NEWS

one thing . . . there is more than one way to skin a stereo cat. Both recordings take a perfectly logical approach to the recording techniques and both come up with results which are quite good. If I were forced to make an absolute choice between these recordings I would be torn between the superior playing of the Boston Pops and Arthur Fiedler's more perceptive performance and the somewhat cleaner, higher resolution of sound on the Capitol tape. I would say that ownership of either tape would be sufficient and representative and there would be little cause to look for "greener pastures."

Slatkin affords a good performance, which moves along briskly and with especially expressive dynamics. But he can't quite match the "mysterioso" effects Fiedler elicits in the "Dawn" section nor match the ferocity and passion of Fiedler's "Storm" finale. Soundwise the directionality is more pronounced here than in the Victor and there is better center fill. The acoustic perspective is broader here and the heavy transients cleaner and better reproduced. What might be a deciding factor for some is the extra work on the Capitol tape . . . the "Mississippi Suite." This is a light-weight and engaging score, the "Mardi Gras" section of which is programmed frequently on "Pops" concerts. The sound here is equally well done and it makes an attractive companion piece to the "Grand Canyon Suite."

"GIGI" SELECTIONS

Radiant Velvet Strings featuring Caesar Giovannini at the piano. Concertapes 601. Price \$11.95.

I have not seen the new motion picture "Gigi" as yet, but I understand that it bids fair to be one of the best musicals produced in recent years. It must be good . . . because to my knowledge this stereo tape is about the ninth recording of all types concerned with the music of "Gigi." I found the six numbers represented here quite ingratiating and certainly some of the best "pop" material to grace the screen in some time.

The theme song "Gigi" is an attractive melody and the other numbers vary from romantic ditties in the Parisian vein to rousing exercises in the best "can-can" tradition. The title implies a string orchestra is used with piano . . . Well there is indeed a string orchestra but there is also an accordion, a set of raucous snare drums, a big tympanum that is wall-popped frequently and with fine abandon, and plenty of assorted bells and other high percussives.

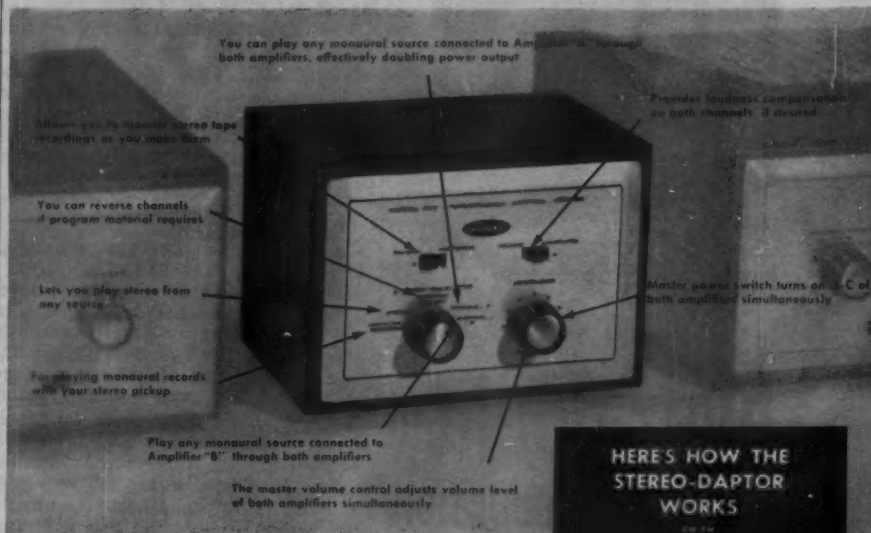
The recording is miked very close-up and is productive of ultra-sharp detail. The acoustics could have been a bit more spacious for my taste but there is no denying that the sound obtained is very bright and powerful. The level on this tape is very high and at times there is a bit of overload distortion. For the most part the tape is exceptionally clean, with fine transient response from the percussives.

September, 1958

95



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Group II: 121-A, B, C; 210-D, E.

Group III: Any systems with separate preamplifiers and power amplifiers.

Group IV: Two identical complete amplifiers having tape monitoring input and output connections.

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Connecting Cables: Four two-foot shielded cables are supplied for all necessary connections. Maximum recommended cable length 3 feet.

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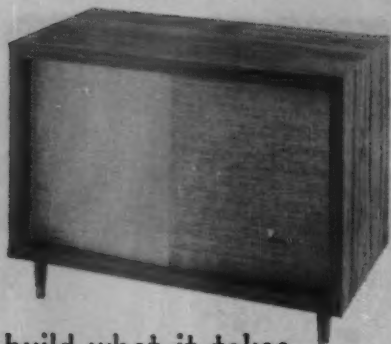
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Stereo effects are much in evidence, the directionality, if anything, a shade too pronounced with a resulting lack of center fill.

This Giovannini chap plays a mean piano, somewhat reminiscent of the style of Carmen Cavallero. The piano is heard, big and full on the right side, while the strings and percussives disport themselves on the left channel. All in all, I found this pleasant listening of the lightweight variety.

SEA OF DREAMS

Nelson Riddle and his Orchestra.
Capitol ZC47. Price \$10.95.

Nelson Riddle is the very clever arranger who is heard to such good advantage on many Sinatra and Nat Cole discs. He has a flair for the dramatic and the romantic that is unerringly in good taste and appropriate to his medium. Here he is on a solo flight with a large string orchestra, which I think is a mistake . . . not because he doesn't do his job very well and with quite some beautiful effects, but rather because the use of strings alone robs us of the opportunity of hearing his superb talents applied to woodwind and brass too.

This is the drift, dreamy type of stuff, lightly confectioned for easy listening. Typical of the numbers that get this smooth treatment are "My Isle of Golden Dreams," "Easter Isle," "There is No You," "Autumn Leaves," etc. The strings are smooth and exceptionally well balanced, never strident and the lower strings have a fine clean rich resonance which is a joy to the ear. Direction, depth, and instrumental separation are all first rate and the whole adds up to a good tape suitable for easy background listening . . . or perhaps some serious romancing!

STRAVINSKY

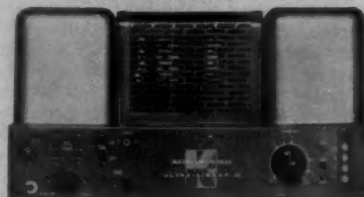
SONG OF THE NIGHTINGALE

Chicago Symphony Orchestra conducted by Fritz Reiner. Victor CCS97. Price \$10.95.

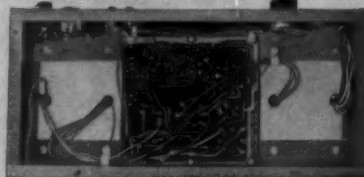
Victor continues to afford us superb stereo recordings utilizing the Chicago Symphony and the magnificent acoustics of Orchestra Hall. This Stravinsky work is certainly a case in point. This is an orchestral suite of Stravinsky's opera "Le Rossignol." Of definitely oriental persuasion, this is based on the old Chinese tale about the "Emperor and The Nightingale." The score is extremely colorful and abounds in both high and low percussives as well as much interesting writing for brass and woodwind.

This work was recently recorded by Ansermet on a London monaural disc. In comparing performances, it is extremely difficult not to be swayed by the fabulous stereo sound of the Victor tape after listening to the work on a monaural disc. Suffice it to say that Reiner's approach is not too much at variance with that of Ansermet, save for matters of tempi where Reiner is a bit faster. The London disc was a fine recording and it will be interesting to hear how it sounds in the stereo disc

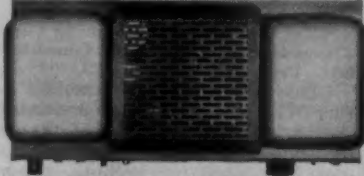
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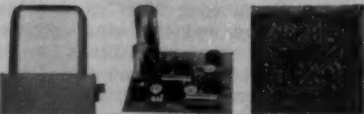
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RADIO & TV NEWS

version that will undoubtedly be forthcoming. It will have to be mighty good to surpass this great recording. This has all the stereo virtues and then some. At all times directionality is easy to perceive and easily maintained, the instrumental separation is outstanding and all this without sacrificing the center channel "fill."

The huge enveloping acoustics of Orchestra Hall are kept well under control and so the heightened orchestral detail afforded by the close-up recording is given a roundness and sense of depth that is astonishing. There are great dynamic climaxes here, all reproduced with outstanding cleanliness and lack of transient distortion. The scoring is quite oriental in its general derivation but with, of course, the tremendously vital originality of Stravinsky everywhere apparent. The score is heavily garlanded with typical Stravinskian atonalities and dissonances, polyrhythms, etc., but all is so cleverly integrated that very few people could find it objectionable.

Reiner gets some truly wondrous playing from his magnificent orchestra and, all-in-all, this is a stereo and musical experience definitely worth the price of admission!

"V.H.F. ROUND-UP"

THE fourth annual Syracuse V.H.F. Round-Up, sponsored by the Syracuse V.H.F. Club will be held on October 11 at Three Rivers Inn just north of Syracuse. Attendees should take Thruway Exit 38 and Route 57 north. Rigs will be on 50.40 and 144.1 to guide visitors.

Tickets are \$5.50 per person and include the dinner, dancing, prizes, and a varied entertainment program.

To pre-register for this event, contact W2EMW, Bob Mele, 18 Homeland No., Syracuse, N. Y.

CLEVELAND MEET SWEEPS

THE Cleveland Amateurradio Convention, scheduled for October 18th at Masonic Temple, Cleveland, is featuring a sweepstakes contest which is open to all classes of amateurs, all hands, all emissions.

The first place prize in each contest class is an expense-paid "day" at the Convention including transportation to and from Cleveland, room, meals, and registration fee. Cleveland area residents will also receive a \$50.00 credit at any local radio jobber.

The contest will run over two weekends, September 26-28 and October 3-5 from 1600 EDT Friday to 2359 EDT Sunday. Operation throughout the 112 hours is permissible. Class A includes all hams outside of Cuyhoga County, Ohio working those in the county while Class B status is reserved for Cuyhoga County hams working those outside the county.

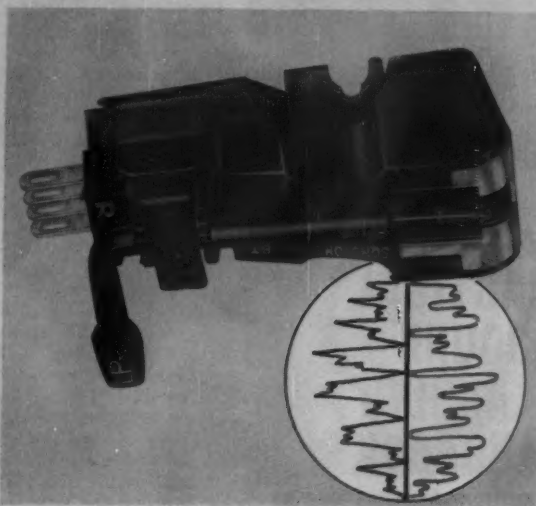
Full details on the contest procedure are available from the Contest Chairman, Cleveland Amateurradio Convention, Box 5167, Cleveland 1, Ohio. Contest logs are to be submitted to the same address and should be postmarked no later than midnight, October 8th to receive consideration.

All hams, YL's, and XYL's are invited to the meet.

September, 1958

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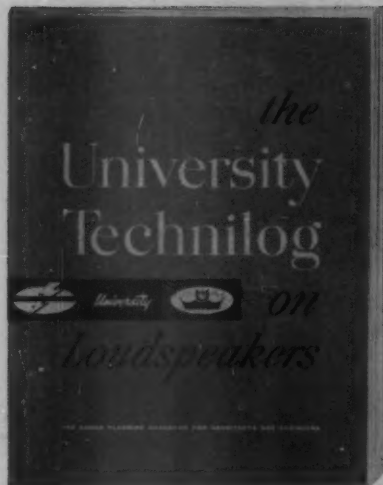
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Reducing Noise and Hum

(Continued from page 59)

nism motor(s) are very potent sources of hum, most likely picked up by the playback head. If the tape machine is troubled by hum from these sources, one may try wrapping a shield around the transformer and motors. This can be fashioned of copper, "Mumetal," silicon steel strips, or "Co-Netic." ("Mumetal" can be obtained on the surplus market for a few dollars in the form of a radar scope shield, but it is difficult to manipulate and may lose its shielding properties if dropped, struck, bent too often, exposed to excessive heat, etc.)

18. Type of Chassis: In building a tape amplifier, an aluminum chassis is preferable to a steel one, for the former does not radiate hum. Also, it has less resistance to circulating currents, including those produced by hum fields, so that the resultant hum voltages present in the chassis are lower.

19. "B+" Filtering: If 120-cycle hum is audible, attention should of course focus on the "B+" supply. Filter capacitors may have gone bad or may have been inadequate to begin with. Addition of a large capacitance, say 40 to 60 μ fd., at the first stage of filtering may improve the situation materially. Sometimes it may be necessary to add a stage of filtering for the first playback tube; this could consist of a 1000-ohm series resistor with a 40- μ fd. shunt capacitor to ground.

20. On-Off Switch: Audio circuits frequently combine the "on-off" switch with the gain control. If the control is at a low-level stage, the a.c. picked up from the adjacent switch may be amplified enough to produce audible hum. A separate power switch may be the best answer, although sometimes it is possible instead to move the gain control to a later stage, provided this does not cause an earlier stage to be overloaded. Connecting a capacitor, about .05 μ fd., from the switch to ground might reduce hum.

21. Power Line Connection: Reversing the power plug in the house line socket often will yield a few db improvement in hum. Where a hum-bucking pot is employed, it may be necessary to reset this pot at the same time.

22. Bottom Plate: A bottom plate on the chassis of a high-gain amplifier can be an effective hum reduction measure.

23. Playback Head: Most playback heads, although not all, are of hum-bucking construction, that is, the head contains two windings which, when properly connected, add up as far as audio signal is concerned but serve to cancel hum picked up by the head and induced in the windings. If the head is defective, for example due to shorted turns, the hum voltages in each winding may be unequal and therefore not completely cancelling. A new head may be the only, although expensive, answer to this problem.

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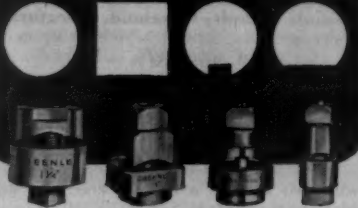
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RADIO & TV NEWS

Audio "Mix-It" Box

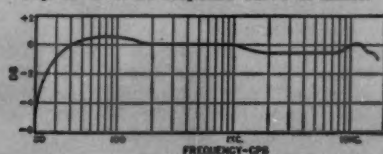
(Continued from page 43)

loudspeaker connected to the 8-ohm output terminals. This permits the equipment to be used for a number of additional purposes. It can be used as a playback amplifier for tapes or discs, as an entertainment amplifier for listening to a radio tuner or record player, or to monitor the signal during an "off the air" recording, or to monitor tape or disc dubbing sessions.

The input connections are mounted on a small strip of metal at the back of the box. The low-impedance microphone receptacle is an *Amphenol* type frequently used with such equipment. The high-impedance microphone plugs into a standard normally closed, single-circuit phone jack. The inputs for the reluctance cartridge and the bridging connector are pin-type phono jacks. A thumb-screw binding post provides a convenient means of connection to the common ground bus, sometimes found necessary for minimizing "ground loops." Note that the ground is *not* carried through the output terminals. All cables from the input terminal strip to the chassis are flexible and shielded for long life and minimum hum pickup from this source. The a.c. line cord plugs into the back of the cabinet. When the "Mix-It" is not in use or is being transported, the power cord can be folded up and stored inside the cover of the cabinet.

With care in wiring, hum and oscillation should not present a problem. Filament wiring, as is good practice, should be done first and should "hug" the chassis. A common ground bus, No. 12 tinned wire, is run about $\frac{1}{4}$ " in space above the pins of the audio tubes, from V_1 to V_4 . All ground connection for these stages should be made to the ground bus, with the cathode and grid resistors terminated at one point for each stage. The ground bus is connected to the chassis at one point only. Experiment will quickly locate that point which gives best results, that is, minimum hum. A small screwdriver, placed against the ground bus and the chassis, is moved along until the optimum grounding point is indicated. In this particular construction that point was determined to be at the approximate center of the ground bus, where the three-section electrolytic, $C_5-C_6-C_{12}$, is mounted. Vent plugs are mounted at the top of the cabinet directly above the tubes. In addition to providing air flow, they enable rapid visual inspection of the tubes with respect to filament glow, just in case some trouble should develop.

Fig. 2. Over-all response curve of mixer.



September, 1958

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New 4-speed Thorens TD-124, with 11½ lb. table, has lowest wow, flutter and rumble of any 12" turntable with equal or less inertia

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leaving unsightly permanent marks:—just replace low-cost arm mounting board, available for 12" or 16" arms in various finishes. Easy to mount, the TD-124 requires only $2\frac{1}{4}$ " clearance below mounting board. Furnished with attached line cord, shielded cable and solder plate. 50/60 cycles, 100/250 volt operation. Simple adjustment; no extra parts.



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Frequency response . . . 30 to 20,000 cycles; flat within ± 1.5 db in fundamental stereo range of 30 to 7,000 cycles.

Channel separation . . . in excess of 20 db.

Uniformly high compliance . . . superior tracking throughout frequency range.

SPECIFICATIONS

Diamond stylus 0.0008 inch radius
Recommended needle force 5 to 7 grams
Compliance, lateral and vertical 2×10^{-6} cm/dyne
Open-circuit output voltage 0.4 volts ± 3 db
Extended stereo range at ± 2.5 db 30 to 16,000 cps

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By MAJOR HARRY LONGERICH, DL4RX/W2GQY

U.S. Army Signal Corps

MANY of us have attempted to receive SSB signals on the conventional type of ham receiver but the results were far from satisfactory. As a matter of fact, this situation has prevented many of us from "reading the mail" on the multitude of single-sideband "QSO's" found on the ham bands today. A surplus LM or BC-221 type of frequency meter used as an SSB detector will, to a great extent, overcome the difficulties usually encountered with the average b.f.o. and second-detector circuitry found in most ham receivers.

If you have an LM or BC-221 heterodyne frequency meter available, it can be converted to serve as a reliable detector. The conversion can be performed in minimum time and with little effort. Basically, the heterodyne frequency meter consists of a stable local oscillator, a mixer, a high-level grid detector, and a stage of audio amplification. It is only necessary to feed the i.f. signal from the station receiver to the antenna terminals of the frequency meter, plug in the phones, turn on the power, and you are in business. The beautiful part of it all is that the frequency meter is used "as is"—no internal modifications are required!

First it will be necessary to take the i.f. signal from the plate of the last i.f. stage in the receiver, through a .004 μ fd., 500-volt mica capacitor, and connect it to the r.f. "CPLG" terminal on the frequency meter. Any suitable length of good coaxial cable may be used between the receiver and the frequency meter. Next, set the LM or BC-221 to the receiver's i.f. frequency. In case of double-conversion superhets, this must be the second i.f. frequency. Generally in most station receivers, this frequency will be in the range of 200 to 500 kc. Advance the "R.F. Coupling" control on the LM series frequency meter to the maximum position (clockwise rotation). The "Crystal" and "Modulation" switch must be in the "Off" position otherwise the detector will not function. Insert the phones in the "Phones" jack on the frequency meter and turn on the power to the receiver and the LM or BC-221.

After an appropriate warm-up period, disconnect the antenna from the receiver, turn off the a.v.c., and set the r.f. gain control on the receiver to maximum. A loud rushing noise should be heard in the phones when the frequency meter is correctly adjusted to the i.f. of the receiver. A touch-up of the last i.f. trimmer capacitors or

tuning slugs may be required; however, in most instances, this should not be necessary.

To insure that the frequency meter is adjusted correctly, rock the dial on the LM or BC-221 back and forth slightly until a peak or maximum noise is obtained. This should be the correct i.f. frequency for your particular receiver. To preclude setting the frequency meter on a harmonic of the receiver i.f. frequency, jot down the exact dial setting of the frequency meter and turn the dial on the LM or BC-221 several hundred dial divisions on either side of the referenced dial setting as noted. Next reconnect the antenna to the receiver, turn on the a.v.c., and tune in an SSB signal. If the signal sounds distorted, back down on the r.f. gain control slightly to keep the detector from overloading. If the SSB signal becomes intelligible on the "high" side of the receiver's tuning capacitor, the received station is transmitting the lower sideband and *vice versa* if the station is transmitting the upper sideband.

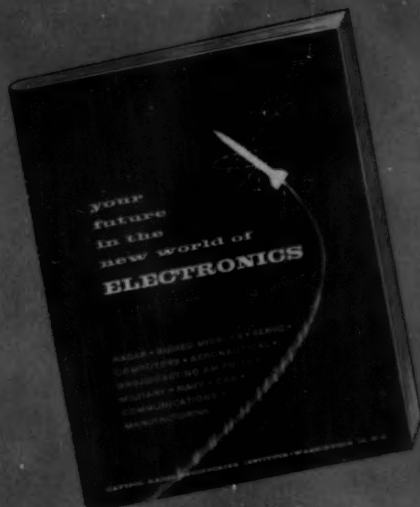
After a few SSB and c.w. signals have been tuned in and you have the "feel" of the receiver, it becomes quite apparent why these detectors work so well for the reception of SSB and c.w. signals. If, for some reason or another, the received signal gets out of synchronization with the detector, a slight adjustment of the tuning dial on the frequency meter will bring the signal "back into the fold" again. Generally, most corrections may be compensated by retuning the receiver only. The frequency meter tuning dial may also be used as a pitch control during the reception of c.w. signals. If it is desired to operate the receiver for the reception of AM signals, it is only necessary to turn the "Freq. Band" switch on the frequency meter to "High."

For those who wish a more sophisticated installation, the output from the "Phones" jack on the frequency meter may be fed back into the normal audio system available in the station receiver. This will permit the use of existing audio and tone controls as before.

The electrical and mechanical stability inherent in the LM and BC-221 series of frequency meters makes them ideally suited as an SSB and c.w. detector. The few minutes of your time that it will take to try this project will more than repay you in operating pleasure and the results are clean SSB, AM, and c.w. signals.

-30-

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Know Your V.O.M. (Continued from page 60)

occur at any point in this range. Therefore, if we are reading 15 volts while using the 100-volt range, we may actually be dealing with as little as 12 or as much as 18 volts. Actually, the accuracy of most meters, particularly on d.c. ranges, is considerably better than this specification would indicate. Nevertheless, it is a good idea, when accuracy is desired, to take voltage readings on the lowest range that is practical, rather than use the lower portion of a higher scale.

Where the accuracy drops off, especially on an older unit, is in the a.c. function. This is usually due to deterioration of the rectifier elements. Resistance readings also deteriorate with battery aging, but are not too accurate even with fresh batteries. If resistance readings fall within $\pm 5\%$ of the actual value, the meter is in excellent calibration. For most service work, even $\pm 10\%$ is sufficiently accurate for resistance measurements. In measuring current, the microammeter itself is found to be quite accurate and so are the shunt resistances which extend its range into the ampere region.

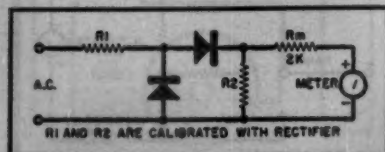
A.C. Voltages

Fig. 3 shows a typical meter circuit for a.c. voltage measurement. The sensitivity here is much less and the loading effect of the meter much greater. While this may vary among manufacturers, 1000 ohms-per-volt r.m.s. is a typical value. This reduced sensitivity is due to the rectifier and additional resistor, both of which dissipate some power and therefore add some loading effect. In some new meters, such as the Hickock 455, a four-section bridge rectifier is used in a high-resistance circuit which results in 20,000 ohms-per-volt sensitivity on the a.c. scale as well as the d.c.

One of the important things to realize is that, with all v.o.m.'s, the a.c. scale is different from the d.c. not only because of magnitude but also because of the non-linearity of the rectifiers. The actual meter indication is calibrated in r.m.s. volts although the meter usually acts on the average value of the rectified current. To convert r.m.s. into peak-to-peak volts, the r.m.s. value must be multiplied by approximately 2.8. However, since most a.c. voltages are normally stated as r.m.s. values, this conversion is not often needed.

Because of the circuitry involved,

Fig. 3. Typical meter circuit, including rectifiers, for a.c. measurements.



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the a.c. voltage ranges are not suitable for measuring higher frequencies. Even for audio work, a separate position of the switch is used. This adds a series capacitor and permits direct connection of the meter to plate circuits. This switch position is usually called the "a.f. output" and, on many multimeters, a special db scale is provided for use in audio measurements. This scale is sometimes based on zero db being at .006 watt across 500 ohms as reference and is useful in p.a. and other audio work where the range of frequencies is not too great. The lower frequencies are limited by the impedance of the blocking capacitor. This impedance becomes smaller as the frequency increases, giving the v.o.m. a frequency-response characteristic of its own. At frequencies above 10,000 to 15,000 cps, the multimeter sometimes has too much input capacitance to be a reliable measuring device. It is useful for relative measurements of audio signals but not for accurate voltage determination over a very wide band of frequencies.

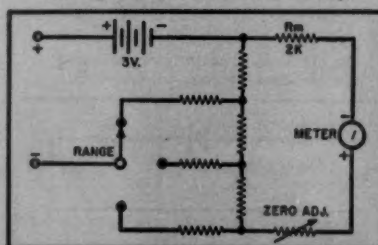
Ohmmeter

Next to measuring voltage, the v.o.m. is most frequently used to check resistance. In service work especially, measuring resistance, checking for open or short circuits, checking capacitors for leakage, electrolytics for capacity, and many other jobs can be done rapidly and simply on the ohmmeter scales. Fig. 4 shows the basic ohmmeter circuit and indicates the importance of observing polarity and range setting.

In connection with the ohmmeter, a few words should be said about one of the most frequent reasons for damaged meters, i.e., using the ohmmeter on live circuits. Damage to resistors and even the meter itself will occur if higher voltages, especially of the wrong polarity, are applied to the ohmmeter terminals. Typical of such accidental damage is the case where first a resistance check is made, then the power turned on and, without changing the v.o.m. selector switch, plate voltage is measured. Bent meter pointers are frequently the result of such carelessness.

Another pitfall is the checking of electrolytic capacitors which might still be charged. In this connection, the possibility of damaging certain types of transistors should be mentioned. This can occur when the ohmmeter polarity is incorrect and the

Fig. 4. The basic ohmmeter circuit, including voltage divider and battery.



voltage exceeds the limits of the maximum permissible between elements.

Once the basic circuits of the various selector-switch positions are understood, servicing is generally quite simple. The most frequent defects include weak batteries, a weak or defective rectifier, open or shorted resistors, and occasionally a defective meter movement. A clear indication of the trouble source is usually obtained from the malfunction itself. If the defect appears only on a.c., then the rectifier and the resistors going to it will be suspect. If it occurs only on one particular voltage range, only the set of resistors used in this range can be at fault. A potential trouble spot which is often overlooked is the selector switch itself. Contacts can become intermittent or break off entirely, wires can break, and short circuits can develop on the switch decks.

It would seem that the best instrument for troubleshooting a multimeter is another multimeter. In actual practice, almost any kind of meter can be used as long as continuity or the lack of it is indicated.

SIMPLE CHECK CRT

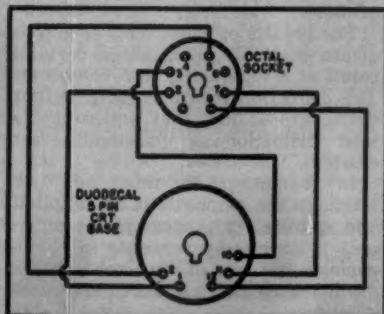
By HYMAN HERMAN

AN INEXPENSIVE check CRT can be made up with little difficulty for substitution in TV receivers where the original picture tube is suspected of being defective. The 5FP7, a long-persistence radar tube which is available at a low price, often under a dollar in the surplus market, can be adapted readily. Although it will not reproduce a TV picture with the same quality that can be obtained on a standard picture tube, it is adequate for its purpose. Since the 5FP7 has an octal base, an adapter will have to be made up, wired as shown in the diagram.

The octal socket is mounted at one end of a cylinder made up of cardboard or stiff corrugated paper, to plug into the back of the 5FP7. The 5-pin duodecal CRT base is fitted to the other end, to receive CRT connections in the receiver. Bare #20 wire covered with spaghetti may be used for making connections.

Since this radar tube is electromagnetically deflected and focused, it uses the receiver's yoke and focus coil and responds to all receiver controls for the CRT. No ion trap is necessary. If the original CRT in the receiver is electrostatically focused, it is a simple matter to add a PM focus assembly with good results.

Wiring for the 5FP7 adapter device.



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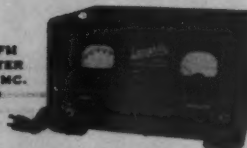
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REX RADIO SUPPLY CO
88 Cortlandt St.
New York 7, N. Y.

In the Heart of New York's Radio Row

The Dyna Preamp

(Continued from page 69)

special feedback pair (dual triode) with equalization determined by feedback at frequency extremes. The tube functions as a low-level amplifier. The second 12AX7, a similar feedback pair, is the tone control section.

In keeping with our policy, this preamplifier like many others in the past, was put through a rigorous laboratory test. The results were gratifying and are as follows:

The sensitivity at 1000 cps for 1-volt output is: tape input, .095 v.; magnetic input, .00168 v. and .0115 v.; tuner and TV inputs, .095 v.; and special input, .00195 v.

Hum and noise (down from 1 volt) for low level phono input is -60 db with shorted input and -41 db with open-circuit input; for high level phono input, -42 db and -41 db respectively; for special input, -51 db and -48 db respectively; and for all other low-gain inputs, -70 db and -63 db under the same conditions.

The frequency response for low-gain inputs is $\pm .35$ db from 20 to 20,000 cps. This extremely flat frequency response occurred at the exact mid-scale settings of the tone-control knobs. No adjustment was found to be necessary.

The treble control range from minimum to maximum positions is -17.4 db and +14 db, respectively, at 20,000 cps. Bass control range is from -21.6 db to +21 db at 20 cps.

The RIAA equalization built into the preamplifier came within $\pm .6$ db of the standard equalization curve from 30 to 15,000 cps.

The loudness control functions extremely well. It provides a smooth bass boost from 0 db at 1 kc. to +17 db at 30 cps at normal output level.

Both intermodulation and harmonic distortion measurements were made under two different operating conditions: "average," 1 volt in and 1 volt out, and "maximum," .5 volt in and 2 v. out. Under these two conditions the intermodulation distortion for tuner input is only .082% and .068% respectively.

The harmonic distortion for "average" operating conditions is .11% at 30 cps, .08% at 1000 cps, and .10% at 15,000 cps. For "maximum" operating conditions, the harmonic distortion is .08%, .07%, and .08% at the same frequencies.

The results of these tests clearly indicate that this preamplifier certainly ranks as a top-quality hi-fi component. The distortion measurements, as indicated, are so low that one could say that distortion is practically nonexistent.

In conclusion, we must add that, although the emphasis is on simplicity and quality, this preamplifier-control unit is extremely versatile in that it permits the use of any modern program source and just about any power amplifier.

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15 Tubes 435 To 500 Mc
Can be modified for 2-way communication, voice or code, on ham band 420-450 mc, citizens radio 460-470 mc, fixed and mobile 450-460 mc, television experimental 470-500 mc. 15 tubes (tubes alone worth more than sale price): 4—7F7, 4—7H7, 2—7E6, 2—6F6, 2—955 and 1—WE91A. Now covers 460 to 490 mc. Brand new BC-645 with tubes, less power supply in factory carton. Ship \$29.50
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SHOCK MOUNT for above..... 1.25
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BC-455 Receiver 6-9 Mc..... 10.95 12.95
BC-456 Receiver Control Box..... 1.49 1.95
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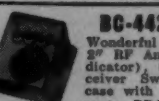
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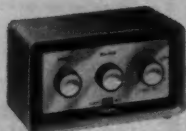
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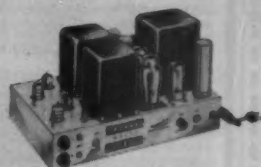
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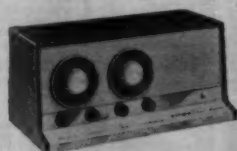
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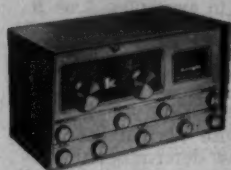


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Convergence Time Savers

(Continued from page 56)

spent in trying to "squeeze" the controls for "perfect" convergence, in this case.

In example C, construction tolerances are definitely toward the extremes. With this condition, the technician can immediately assume that final vertical convergence will be considerably more difficult to achieve and could easily result in less satisfactory convergence than in examples A or B. It should be noted that example C could also indicate a fault in the receiver convergence circuits, a magnetized CRT, etc. However, for our examples, remember that we have assumed an otherwise normal receiver. The technician now determines the results he can expect after final vertical adjustments, and can thus avoid time spent in trying to achieve the impossible.

Horizontal dynamic convergence can be analyzed in a similar manner. After performing the two steps mentioned previously, the technician also observes the symmetry of the horizontal row of dot trios (through the center screen area). A pattern similar to one of the three examples shown in Fig. 2 may appear.

The same analysis can be applied to the horizontal dynamic convergence procedure that has been suggested for achieving vertical convergence. The separation between dots in Fig. 2A proceeds equally and symmetrically from the center to either side. In B, the red (R) dots are slightly up toward the right side as compared to the relative side-by-side positioning of green and red dots on the left side of the screen. In C, the dots are unequally spaced, and groups toward the left have less separation than groups toward the right. Green and red dots are not side by side.

The number of different examples that could be shown is probably unlimited. However, we are only trying to provide sufficient information to show how the condition of the receiver can be determined in this respect.

With experience, the technician will undoubtedly develop additional techniques. Setting up a color receiver for purity, convergence, and grey-scale tracking are all very important—and convergence is the most time-consuming of these. These adjustments should never be performed hastily. At the same time, it is possible to avoid needless repetition.

Color TV manufacturers do differ slightly in the methods they recommend for convergence set-up. These differences should not confuse the technician once he realizes what these controls do, and how they affect dot movement. With a little practice, he becomes familiar with the preliminary steps involved. Being able to anticipate and approximate the expected results has definite advantages. —[M]

Using Your Bug Right!

By
WILLIAM MORRIS DORSEY
ex-W4KXX

A few minor adjustments will help eliminate sloppy code.

ANYONE who has worked or listened-in on the various c.w. bands must have been unfavorably impressed by some of the sloppy, uneven sending. Some operators using bug keys seem to have a habit of adding an extra "dit" here and there, making it difficult to understand the message being sent.

Operators of a bug key should put in hours and hours of practice on a code oscillator before they go on the air with a bug. By developing a smooth and rhythmic style of keying you will derive more pleasure from your hobby and your fellow ham on the receiving end will recognize and appreciate your professional "flist."

In the author's opinion, the major cause of "ragged" bug keying can be attributed to the operator's inability to keep his bug in adjustment. The first requirement is to see that the bug's pivot bearings are correctly adjusted so that the armature is at the right height. Make sure that the contacts are level. Bearings must be adjusted so that there is a minimum amount of side play. The right-hand armature adjustment stop should be screwed down until the armature barely touches its damper wheel when the armature is pushed against this stop.

Next, the left-hand armature adjustment stop should be turned until the end of the armature oscillates whenever it is pushed toward the stop, using moderate finger movement.

The armature return spring is set so that it will spring back with the right tension yet not bounce when it hits the stop. For most bug operators, the armature weights are set about two-thirds of the way, but for beginners who might wish to send at slower speeds, the weights can be set about three-quarters of the way down.

It is very important that the dot adjustment screw be set precisely. First, the armature is moved to the dot portion of the key. Hold it there until oscillations cease.

Then you should carefully adjust the dash screw until it moves the same distance as when making a dot. The same spring tension is required for controlling both the dots and dashes.

-30-

September, 1958

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What's the secret? For many it's the *Photography Directory & Buying Guide* . . . a handsome catalog of all photographic equipment on the market compiled by the editors of *Popular Photography*. It tells you everything you want to know about more than 5,000 products, from cameras and lenses to film and filters—for black and white or color, for movie or still photography. The cost? Only \$1.00.

Besides listing over 5,000 new photo products (and illustrating more than 1,000 of them), the 1958 *Photography Directory & Buying Guide* includes helpful, simplified **CAMERA COMPARISON CHARTS**. These charts compare the prices, shutter ranges, lens speeds and other features of over 300 press, 35mm and reflex cameras. In addition, a special 16-page section on **FOTO FACTS** gives data and figures on filters, films, lenses, exposure and conversion scales. An exclusive bonus, **PHOTO SHORTCUTS** points out ways to save money when you shoot, light, print and process. A section on **PORTRAIT LIGHTING SET-UPS** lists tested diagrams for lighting a model. As additional features, the 1958 *Photography Directory* suggests sample **MODEL RELEASE FORMS** and a roundup of the **LATEST BOOKS ON PHOTOGRAPHY**.

The new *Photography Directory* is now on sale. This 1958 Edition, priced at only \$1.00, will sell fast! So to insure yourself of a copy, pick one up at your newsstand or photo dealer's now.

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The most famous broad-band antenna in the country. Unparalleled gain on channels 2 through 13.



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ARR/RCA SIX TUBE all purpose super hot RECEIVER covering 195 KC to 9000 KC including weather lighthouse, aircraft radio range broadcast, marine and amateur 160 meter, 80 meter, 75 meter and 40 meter, with tubes, 24 volt dyno, and schematic. **\$17.95**

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BC603. Ten Channel Push-Button on continuous tuning FM Receiver 20 to 27 Mc, complete with tubes, speaker, squelch circuit. **\$12.95**
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BC449. Six Channel Crystal Controlled. 50 Watt Radio Telephone, 1600 to 4500 KC. Ideal for boats or land station, less power supply. Used **\$59.50**
\$45.00 Hi-Fi Headset—Uses angular grooved plastic fibre cones with voice calls as in speakers, and rubber ear pads to obtain spacing for correct acoustical load. GIVES FINEST MUSIC REPRODUCTIONS! Input 300 Ohms per unit or 600 Ohms when wire series.
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- #1110 VERTICAL/LATERAL
- #1109 TRACKING
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Set of 6, **4.95**

CHEST MICROPHONE TD1

3-position switch impedance 200 ohm.

\$1.95

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Magnetic Check for Tools

By ROBERT JASON

Use a magnetic compass.

TOOLS used around tape recorder heads and magnetic pickups should either be made of nonmagnetic materials or, if made of magnetic material, should be checked before each use to make certain that they are in a demagnetized condition. This applies particularly to screwdrivers, which may again be magnetized by tomorrow although they are demagnetized today. Therefore, a check should be made immediately prior to work on any type of unit, including those already mentioned, which may be adversely affected by the use of a magnetized tool.

Constant re-checking can be a nuisance, but a simple technique involving a readily available aid takes the annoyance out of the procedure. Any inexpensive compass kept handy on the bench will serve the purpose. A non-magnetized tool made of magnetic material will attract either end of the compass needle, as is shown by the attraction between the handle of a screwdriver and the compass needle in Fig. 1.

If the screwdriver or other tool is indeed magnetized, either one of its ends will repel either one or the other of the ends of the compass needle. This is shown in Fig. 2, where the blade of a magnetized screwdriver pushes away the compass needle. It makes little difference which end of the tool repels which end of the needle, as long as magnetization exists. —50—



Fig. 1. A nonmagnetized tool will attract either end of the compass needle.

Fig. 2. One end of a magnetized tool will repel one end of a compass needle.



McGEE'S 1959 SLIMLINE HI-FI AMPS B-W 2- FOR STEREO

FACTORY WIRED AT KIT PRICES—

SLIM LINE SL-20
16 WATTS
 PUSH PULL EL-84
\$34.95
 RESPONSE 15 CPS TO 22,000 CPS
 ORDER WITH A SPEAKER AND SAVE

★ WITH CU-14Y 12" COAX \$44.95 ★ WITH B-125X SPEAKER \$51.95
 ★ WITH P15-OR 15" COAX \$49.95 ★ WITH B-347 SPEAKER \$59.95
 WITH NORELOCO 12" 9762-M \$69.00

New, 1959 model Imperial Slim-Line 16 watt high fidelity amplifier (30 watts peak), with built-in pre-amplifier. Full range audio response from 15 to 22,000 cps. Dual tone controls: full 18 db bass and full 18 db treble boost. Input for radio tuner, tape recorder and phono. Input compensation for the new 1959 model 4 gram General Electric variable reluctance cartridge as well as RPP-050, RPP-052 and crystal phono cartridges. B position selector switch selects inputs and record compensation. Compensation for AES and RIAA phono records. A factory built amplifier at less than kit prices. Output impedance matches 8 or 16 ohm high fidelity PM speakers. Price includes tubes: 2-12AX7, 1-12AU6, 2-EL-84 and 9Y30T. Modern multi-color leatherette covered wood cabinet, no added cost matches blond or mahogany finish speaker systems. Size: 9 1/4" tall, 11 1/4" wide, 8" front to back. Ship. wt. 18 lbs. Model SL-20 Imperial, List price, \$69.00. McGee's Sale Price, \$34.95.

SLIM LINE SL-70
12 WATTS
 PUSH PULL 6V6
\$24.95
 RESPONSE 20 CPS TO 17,500 CPS
 ORDER WITH A SPEAKER AND SAVE

★ WITH CU-14Y 12" COAX \$34.95 ★ WITH B-125X SPEAKER \$41.95
 ★ WITH P15-OR 15" COAX \$44.95 ★ WITH B-347 SPEAKER \$59.95
 WITH NORELOCO 12" 9762-05 \$49.95

New, 1959 model Imperial Slim-Line, 12 watt high fidelity amplifier (16 watt peak), with built-in pre-amplifier. Full range audio response from 20 to 17,500 cps. Dual tone controls: full 12 db bass boost and full 18 db treble boost. Input for radio tuner or tape recorder and phono. Input compensation for the new, 1959 model 4 gram General Electric variable reluctance cartridge as well as RPP-050, RPP-052 and crystal phono cartridges. Compensation for AES and RIAA phono records. A factory built amplifier at a price you might pay for a kit that actually includes less material. Output impedance matches any 8 ohm high fidelity PM speaker. Price includes tubes: 2-12AX7, 2-6V6GT and 9Y30T. Modern multi-color leatherette covered wood cabinet, matches blond or mahogany finish speaker systems. Size: 9 1/4" tall, 11 1/4" wide and 8" front to back. Ship. wt. 13 lbs. Model SL-70 Imperial, List price, \$49.95. McGee's Sale Price, \$24.95.

STEREO CONTROL FOR SL-10 ON SL-20 \$6.95

8 TUBE FM AM TUNER
\$34.95
 Jackson 8 tube, FM-AM tuner. 9 inch slide rule dial with excursions and tone channels. Includes 12AX7, 6BE6, 2-6AR5, 6AT6, 6AL5, 6X4 and 6AR5. Full range audio output. Will feed into any Hi-Fi amplifier. Full superhet circuit. Receives broadcast 540 to 1600 KC, plus FM 88 to 108 MC. Controls: volume, tuning, AM-FM switch, auto-tune control. Only 100 to sell at the low price of \$34.95. Stock No. VAB-70.

TWO-TUBE SARKES-TARZIAN TV TUNER WITH TUBES
21 MC PENTODE OR 41 MC CASCADE
SALE \$7.95 2 FOR \$14.95

No. TT-3A, 2 tube 21 mc Sarkes-Tarzian Pentode TV tuner. 12 position, 12 channel VHF complete with 6AR5 and 6BE6 tubes. This popular tuner used in Arvin, Air King, Airline, CBS, Crosley, Firestone, Hallcrafters, Westinghouse and others. Specify shaft length, 2 1/4", 2 3/4" or 2 1/2". Ship. wt. 2 lbs. Sale price, \$7.95 each, 2 for \$14.95. Available with longer shaft 3 1/4" to 3" long at \$1.00 extra. SCK-3, set of matching knobs for selector and fine tuning knobs, \$9.00.
 No. TT-3C, 2 tube 41 mc Sarkes-Tarzian Cascade TV tuner. 12 position, 12 channel VHF switch type. Complete with 6BE6 or 6BE7 and 6J6 tubes. This popular tuner used in many makes of TV sets including Arvin, Crosley, \$29.95, \$34.95 and \$49.95 models. Westinghouse V1148S. Available with shaft 3 1/4", 4", 4 1/4" and 4 1/2" long. Ship. wt. 2 lbs. Sale price, \$7.95 each, 2 for \$14.95. For 9" shaft, add \$1.00. SCK-3, set of matching selector and fine tuning knobs, \$9.00.
 No. ST-4B, 2 tube 41 mc Sarkes-Tarzian Cascade TV tuner. 12 position, 12 channel VHF complete with 6AR5 or 6BE6 and 6J6 tubes. Used in Westinghouse models V-982A, V-10750, V-10905 and V-11385-1. Shaft lengths 3 1/4", 4" and 4 1/4". Ship. wt. 2 lbs. Sale price, \$8.95; 2 for \$16.95. SCK-3, set of matching selector and fine tuning knobs, \$9.00.
 No. TT-1A, 2 tube 41 mc Sarkes-Tarzian Cascade TV tuner. 10 position switch type for 12 channel VHF and 4 position for UHF converter (UHF converter not furnished). Complete with tubes, 6BE6 and 6BE7. Has 3 1/4" shaft for Westinghouse V-1133-1, etc. Sale price, \$8.95 each, 2 for \$16.95.
 No. TT-5D, 2 tube 41 mc Sarkes-Tarzian Cascade TV tuner. 14 position switch type for 12 channel VHF and 2 position for UHF converter. (UHF converter not furnished). Complete with tubes, 6BE6 and 6BE7 and 6J6 and channel selector knob. For Westinghouse models V-11794-1 and V-12400-1. Shaft length 7 1/2". Sale price, \$9.95 each, 2 for \$19.95. Available 9 1/4" shaft at \$1.00 extra.
 No. TT-6A, 2 tube 41 mc Sarkes-Tarzian Cascade TV tuner. 18 position switch type for 12 channel VHF and 4 positions for UHF converter. (UHF converter not furnished). Complete with tubes, 6BE6 and 6BE7. For Westinghouse model V-10880-2, also Arvin. Shaft length 3 1/4". Sale price, \$9.95 each, 2 for \$19.95.

MINIATURE BROADCASTING STATION FOR MICROPHONE AND PHONO WITH CRYSTAL MICROPHONE
SALE PRICE \$9.95

Sensational new model MCL-ES miniature broadcasting station for microphone and phonograph. Can be received on any broadcast radio in the home. No wires to connect, tunes in just like radio station. Has input jacks for crystal mike or record player. Complete with 12X8 and 70L7 tubes and instructions. Operates on 110 volts AC. Simple to operate; one control fades from microphone to record. Frequency can be adjusted so as not to interfere with local radio stations. Miniature broadcasting station, complete with crystal hand mike and instructions. Ship. wt. 4 lbs. Net price, \$9.95.

STEREO HI-FI SPEAKER SYSTEM
\$89.95
 ALL IN ONE BLOND DAFFLE
 30 WATTS, 25 TO 18,000 CPS

New, 1959 model Stereo speaker system all in one enclosure. Bass is covered with full length 33 1/2" high, 3 1/2" wide and 3 1/2" front to back. A fully enclosed, acoustically line baffle with two identical wide range speaker systems in one enclosure. Twin 12" Magnavox woofers, 8" mid-range, 4" cone horn tweeter and 4" high frequency tweeter speaker systems. May be paralleled to be an 8-speaker monaural system or two 4-speaker Stereo system. LC crossover networks are built-in. Output impedance 20 ohms monaural. Will handle 20 watts monaural or 18 watts Stereo. Response 25 to 18,000 cps. Ship. wt. 120 lbs. Model No. STRO-30B, Sale price, \$89.95.

IMPERIAL HI-FI SPEAKER SYSTEMS

Imperial 91 and 91 systems are offered in the larger 18" or 24" mahogany cabinet, 37" tall, 27 1/2" wide and 33 1/2" front to back. Enclosure is acoustically lined to approach an infinite baffle. Ideal for any Hi-Fi system and priced at worth of speakers alone. LC crossover network and variable brilliance control. Features heavy woofers and horn tweeters.

IMPERIAL 91 \$69.95
 25 watts, response 15 to 20,000 cps. A complete speaker system in the above described enclosure, ready to connect to your Hi-Fi amplifier. Built-in LC 3 way crossover network. Speakers included are 18" 21 1/2" sq. Utah woofer, 8" 6.8 ohm mid-range and horn type Pioneer PT-3 tweeter, 8 ohm impedance. Stock No. Imperial 91, speaker system. Ship. wt. 60 lbs. Sale price, \$69.95.

IMPERIAL 91 \$69.95
 Imperial 91, 30 watt speaker system with 5 speakers. Response, 15 to 20,000 cps. A complete speaker system in the above enclosure, ready to connect to the 8 ohm output of your high fidelity amplifier. Includes the 21 sq. Utah 15" woofer, two of the 8" sq. mid-range speakers and two of the PT-3 Pioneer horn type tweeters. Built-in LC type, 3 way crossover network. Imperial 91, speaker system. Ship. wt. 60 lbs. Sale price, \$69.95.

STANDARD COIL REPLACEMENT TV TUNERS

New, "TV" type, single strip Standard Coil Pentode tuners. Available for 21 mc, for other series or parallel filaments. These are the latest single strip type tuners. 12 position, 12 channel VHF with regular 1/4" shaft having 26" concentric fine tuning. Your choice of tuner with 1 1/4", 2 1/4" or 3 1/4" shaft length. Sale price, \$9.95 each, 2 for \$19.95.
 Tuners with 4", 4 1/4", 5", 6 1/4", 7", 8 1/4" or 10 1/4" shaft lengths. Sale price, \$10.95 each, 2 for \$21.95.
 No. TAA-050, 2 tube 21 mc Pentode tuner with parallel filaments. Complete with 6BE6 and 6J6 tubes. Replaces TV-100, TV-200, TV-300, TV-1300 and TV-1500.
 No. TAS-050, 2 tube 21 mc Pentode tuner with series filaments. Complete with 3BC6 and 6J6 tubes.

STANDARD COIL CASCADE TV TUNERS

Tuners with 4", 4 1/4", 5", 6 1/4", 7", 8 1/4" or 10 1/4" shaft lengths. Sale price, \$12.95 each, 2 for \$25.95.
 No. TCA-050, 2 tube 21 mc Cascade tuner with parallel filaments. Replaces 2000, 2300, 2300, 4500 series and others with 6BE7 or 6BE6 and 6J6 tubes. Net \$13.95.
 No. TC-050, 2 tube 41 mc Cascade tuner with parallel filaments. Replaces TV-3000, 4400, 4500, 4500, 8000 and 8900 series. Complete with 6BE7 or 6AT6 and 6J6 tubes. Net \$13.95.
 No. TCB-050, 2 tube 41 mc Cascade tuner with series filaments. Complete with 6BE7 and 6J6 tubes. Net \$12.95.
 No. TDC-050, 2 tube 41 mc Cascade tuner with series filaments. Complete with 6BE7 and 6J6 tubes. Net \$13.95.
 Set of matched knobs for above Standard Coil tuners. Molded mahogany bakelite with gold markings and metal inserts. Stock No. SCK-3 pair of knobs for channel selector and fine tuning, \$9.00.
 Set of matching mahogany bakelite knobs for volume and contrast. Stock No. VCN-2, \$9.00 per pair.

McMURDO SILVER TUBES—NEW LOW PRICES—ORDER NOW

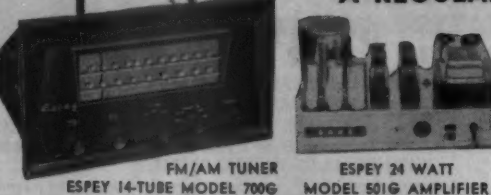
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1B5	2.55	.59	4BC8	4.05	.79	6BG6G	6.50	1.49	12BE6	2.15	.59	25L6GT	2.20	.69
155	2.55	.59	4BN6	3.05	.79	6BH6	3.50	.89	616	2.80	.59	35B5	2.65	.59
174	2.40	.59	4BU8	2.80	.69	6BN6	3.05	.89	65N7GT	2.60	.69	35C3	2.15	.59
1U4	2.35	.59	5BR8	3.30	.79	6BG6GA	4.35	.99	678	3.35	.79	35L6GT	2.40	.79
1U5	2.05	.59	6AB4	2.15	.55	6BQ7	3.95	.99	6U8	3.30	.79	50C3	2.15	.39
1X2A	3.05	.79	6AM8	3.25	.79	6BU8	2.80	.79	6W4GT	2.40	.69	50L6GT	2.40	.79
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3BZ6	2.25	.59	6BC8	4.00	.79	6CT7	2.95	.79	12AU6	2.15	.49	17W6GT	2.70	.69

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22 TUBE ESPEY FM-AM HI-FI TUNER-AMPLIFIER SALE PRICE \$99.95

A REGULAR \$199.50 NET VALUE COMBINATION FOR \$99.95



FM/AM TUNER ESPEY 24 WATT
ESPEY 14-TUBE MODEL 700G MODEL 501G AMPLIFIER

MODEL 700G SPECIAL
FM-AM TUNER SALE PRICE
AND BOTH FOR
MODEL 501G \$99.95
AMPLIFIER
ATTRACTIVE LEATHERETTE
TUNER CABINET \$7.95 EXTRA

McGee offers you both the regular \$119.50, 14 tube Deluxe FM-AM tuner and the regular \$79.50, 8 tube audio amplifier for the special sale price of only \$99.95. The Model 700G Espey tuner has its own built in power supply. Performance features are: Sensitivity 4mv on AM, 8 mv on FM for 30 db quieting. AM selectivity 10kc at 5 db. FM 240 kc at 8db. Audio response flat from 30 cps to 20,000 cps, with less than 1/4 percent distortion with one volt audio output. Chassis is 14" long, 8 1/2" high and 10" deep. Features a one-piece molded, gold color plastic front which makes a custom installation both extremely attractive and easy at the same time. Full tuned RF stages-ARC on FM with detuning switch for easy FM tuning. Built-in preamplifier for GE or other popular variable reluctance cartridges. Three position equalizer switch for LP, AES or European records. Separate bass and treble tone controls with 23db boost. Chassis is equipped with AC outlet jacks, auxiliary input jacks for tape recorder, etc. Has built-in ferrite loop antenna for AM broadcast band and 300 ohm input for FM band. This fine quality FM-AM tuner is second to none. It has all of the features that you might expect of a tuner that would cost as much as \$200. All of the controls are on the front panel. This is a most desirable feature when the tuner is used in conjunction with a good audio amplifier, such as the 501G which was designed with no tone control or preamplifier circuits.

The Model 501G, 8 tube ultra-linear high fidelity, 24 watt audio amplifier is made to match the 700G tuner. This amplifier features less than 1/2 percent distortion with high fidelity response from 10 cps. to 20,000 cps. Hum level so low it can be detected by electrical instruments only. Chassis size, 12"x8"x6". Output tubes: 4-6V6GT in push-pull Williamson circuit. 6SN7GT phase inverter and 2-5Y4GB rectifiers. Has an 8 pound potted case output transformer with specially made grain-oriented iron core. Output impedance taps of 4, 8 and 16 ohms. This output transformer alone is a \$30.00 value.

Buy both the 700G FM-AM tuner and the matching 501G amplifier for only \$99.95. Tuner shipping weight 20 lbs. Amplifier shipping wt. 22 lbs. See the special deals of the 700G-501G tuner-amplifier combination with record changer and GE cartridges for extra money saving values. Also, special discount on speakers and speaker systems when ordered with your Espey tuner and amplifier.

ESPEY DEAL-1A

Espey 700G-501G tuner with 24 watt amplifier plus VM-936 GE 3 speed VM on metal base-1 mil diamond needle \$124.95

ESPEY DEAL-2

Espey 700G-501G tuner with 24 watt amplifier plus new 45S Collaro changer equipped with GE RFX-082A cartridge. Net \$144.95

ESPEY DEAL-3

Espey 700G-501G tuner with 24 watt amplifier plus Garrard RC-98 equipped with a GE RFX-082A cartridge. Net \$174.95

SPEAKERS RECOMMENDED

Order any of the following speakers with your Espey tuner and amplifier:

12" coaxial PM, CU-14V-\$10.00 extra
15" coaxial PM, P15-CR-\$20.00 extra
Imperial IV system-\$15.00
Imperial VI system-\$25.00

Norelco 9763-12" regularly \$89.50 at \$30.00 extra.

24 INCH CUSTOM TELEVISION CHASSIS \$129.95



McGee offers this nationally famous make 24" television chassis with aluminum picture tube and a service saving Full power transformer operated with switch type cascade tuner. All regular wiring-one printed circuit. Chassis is mounted on a baseboard and shipped with picture tube installed. Area required for chassis: 28" wide, 20" high and 20" front to back. Safety glass size 22 1/2" x 18 1/2". Tuner and controls are mounted on a separate vertical bracket to make it easy to move when installing. Price includes all tubes and 24" 24V4 aluminum picture tube. Knobs and safety glass included. Good quality audio. 2-8" and 2-3" speakers are furnished. Mounted on a baffle board 24"x18 1/2". Stock No. M075-02, with all tubes and 48 day picture tube warranty. Sale price, \$129.95. Price with one year picture tube warranty, \$133.95.

Stock No. M075-01, similar includes a 21" 21AT6A aluminumized picture tube. Price includes a 21" 21AT6A aluminumized picture tube. 3 year picture tube warranty. 3 year picture tube warranty. \$4.00 additional. 3 speed automatic Collaro record changer, plugs into any of the above TV chassis, \$24.95 extra.

ALLIANCE "IT" T.V. TUNER REMOTE CONTROL REG. \$19.50 LIST \$4.94



McGee Special Purchase Sale! Alliance "IT" remote tuner for your TV set. A small battery operated motor turns your tuner clockwise or counter-clockwise. Attractive battery case fits into back of your hand. Made to sell at over \$14.00 dealers net. McGee offers them for \$4.94, 3 for \$12.50 with flashlight batteries. Also adaptable to many other uses. Add 48¢ per unit for packing and postage.

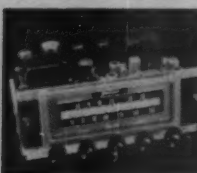
4-SPEED PROFESSIONAL TURNTABLE \$44.95 FINE IMPORTED VALUE



DOUBLE REFLECTION BUILT-IN STROBOSCOPE. Motor-4 pole induction type, 110-117 V AC, 60 cycles only; Speeds-4 speeds-16 2/3, 33 1/3, 45, and 78 rpm.; Speed Adjustment-2.5%; S/N Ratio-44 db.; Wow-less than 0.2%. Designed and engineered to achieve the ultimate in Hi-Fidelity. Reproduction of Disc Recordings, bringing out the best in music at all speeds. Turntable is Aluminum and cannot cause leakage of magnetic flux to the cartridge. Neither can motor vibration affect pickup performance because all vibrations are effectively damped through a flexible rubber motor mounting. A universal slotted mounting bracket is furnished and is adjustable for all types of 12" or 16" professional type tone arms, with template for mounting. Stock No. 1900, sale price \$44.95. CBS-licensed 12 inch viscous damped arm as pictured \$9.95 extra. CBS-licensed 18 inch transcription arm \$14.95 extra. Order a stereo cart. as offered below-4 speed Professional turntable, same as above, but no probe. Powered with a positive speed MYSTERIE motor. Model C-1000HS, Sale price \$49.95. Use with 12" or 16" arm priced above. These new motors are a must for stereo records.

STEREO PHONO CARTRIDGES

McGee has a large stock of Crystal Stereo cartridges on hand. Output voltage about 1/2 volt. Here are the more popular makes. They fit the transcription arm shown above and most all record changers. ASTATIC Soundro Flipover Stereo No. 1178-with 3 1/2 mil sapphire needles-Net \$4.65. ASTATIC No. 1378 Soundro Stereo with 7 mil and 3 mil sapphire needles. ASTATIC No. 1378X Flipover Soundro with 3 mil sapphire and 7/10 mil diamond needle-Net \$12.95. ELECTROVOICE Model 21B has a single 7/10 mil diamond needle-response 15,000 cps-Net \$9.15. ELECTROVOICE Model 26DST has a single 3 mil sapphire and 7/10 mil diamond needle-Net \$22.05.



JACKSON AM9A

13" x 9 1/2" x 6" high. With tubes: 2-6X6, 6-6X6, 6-6X6, 6-6X6, 2-6V6 and 6V3. Knobs, ecutcheon, diagram and instructions included. Model AM9A. Ship. wt. 18 lbs. Sale price, \$34.95. CU-14V 12" coax speaker, \$10.00 extra; 15" coax speaker, \$20.00 extra.

McGEE RADIO COMPANY

PRICES F.O.B. KANSAS CITY
CASH OR FULL
REMITTANCE WITH ORDER.
BAL. SENT C.O.D.

TELEPHONE VICTOR 2-5092
1903 McGEE ST., KANSAS CITY, MISSOURI

AUTOMATIC CHANGERS AT LOW PRICES



MONARCH UA8H

Special prices on VM 3 speed Hi-Fi record changers. Equipped with plug-in heads. Features a 4 pole motor, intermixes 10" and 12" records. Shuts off after last record has played. Size: 13 1/2" x 13 1/2" x 13 1/2". Ship. wt. 12 lbs. VM-936 and VM-936H on the same changer except the 936 is on a base as illustrated. Price includes 45 RPM spindle. VM-936H on base with RFX-082A G.E. VR cartridge, \$39.95. VM-936H on base with RFX-082A G.E. VR cartridge, \$39.95. 1 mil diamond needle, \$4.95 extra.

Latest 4 speed English imported Monarch record changer. Features a 4 pole motor, 0" turntable with molded rubber record pallet. Balanced tone arm readily accepts most makes of Hi-Fi cartridges. Plays 16 2/3, 33 1/3, 45 and 78 RPM records. Intermixes 10" and 12" records. Shuts off after last record has played. Compact size, 12 1/2" x 10 1/2" x 10 1/2". Ship. wt. 15 lbs. Large 45 RPM spindle, \$1.95 extra. Choice of blond or mahogany wood mounting base, \$4.50 extra. Offered with Ronette flip-over Hi-Fi crystal cartridge, \$22.95. UA8-RD with Ronette cartridge as above and extra 1 mil diamond needle, \$29.95. UA8-4050 with latest G.E. VR cartridge, \$29.95. 1 mil diamond needle, \$4.95 extra.

Latest Garrard Renown II, RC-121 II, latest 1958 Garrard Hi-Fi, 4 speed changer with plug-in head shell, Net \$42.50, with G.E. 40-050 cartridge, \$91.45, with G.E. 40-052 cartridge, \$61.80. 48 RPM spindle, \$3.50 extra.

3 SPEED HI-FI COLLARO Model RC-34, 3 speed (33 1/3, 45 and 78 RPM) Collaro record changer. A safe model High Fidelity record changer with a ceramic crystal cartridge (no pre-amplifier required). Features diamond 1 mil and sapphire 3 mil needles. Size, 12" x 13 1/2" x 13 1/2". For 110 volt, 60 cycle AC operation. These changers were intended for use by a nationally known Hi-Fi set manufacturer. McGee bought them at a substantial saving. Stock No. RC-34 Collaro changer with crystal cartridge, equipped with diamond 1 mil and sapphire 3 mil needles. McGee Sale Price, \$27.95. Two leatherette covered wood base, 13 x 14 1/2 x 3 1/2", shipped separate at \$3.00 extra.

NEW—SMALL VOLT-OHM METER 2000 OHMS PER VOLT AC-DC WITH TEST LEADS 2 FOR \$19.50—4 FOR \$37.00

New, small Volt-Ohm meter 3 1/4" tall, 3 1/2" wide and 1 1/4" thick. 2 1/2" motor. Sensitivity 2000 ohms per volt. DC volts 0 to 1000 in 5 ranges; AC volts 0 to 1000 in 5 ranges; current 0 to 500 ma. in 3 ranges; Resistance 2 ohms to 1.8 megohms in 3 ranges; Decibels minus 20 to plus 16 (0db. 75 db. 100 db. 120 db. 140 db. 160 db. 180 db. 200 db. 220 db. 240 db. 260 db. 280 db. 300 db. 320 db. 340 db. 360 db. 380 db. 400 db. 420 db. 440 db. 460 db. 480 db. 500 db. 520 db. 540 db. 560 db. 580 db. 600 db. 620 db. 640 db. 660 db. 680 db. 700 db. 720 db. 740 db. 760 db. 780 db. 800 db. 820 db. 840 db. 860 db. 880 db. 900 db. 920 db. 940 db. 960 db. 980 db. 1000 db. 1100 db. 1200 db. 1300 db. 1400 db. 1500 db. 1600 db. 1700 db. 1800 db. 1900 db. 2000 db. 2100 db. 2200 db. 2300 db. 2400 db. 2500 db. 2600 db. 2700 db. 2800 db. 2900 db. 3000 db. 3100 db. 3200 db. 3300 db. 3400 db. 3500 db. 3600 db. 3700 db. 3800 db. 3900 db. 4000 db. 4100 db. 4200 db. 4300 db. 4400 db. 4500 db. 4600 db. 4700 db. 4800 db. 4900 db. 5000 db. 5100 db. 5200 db. 5300 db. 5400 db. 5500 db. 5600 db. 5700 db. 5800 db. 5900 db. 6000 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BUY YOUR TOP-QUALITY-LOW COST HI-FIDELITY FROM McGEE

NEW 1959 MODEL HIGH-FIDELITY SPEAKER SYSTEM ON BAFFLE BOARD \$29.95



FEATURES 15 INCH MAGNAVOX WOOFER 12 INCH MID-RANGE MATCHED TWEETERS

Model VOX-1512, high fidelity 25 watt, 4-way speaker system. Factory manufactured on a baffle board 16" x 33". The speakers featured in this system have been laboratory matched to work as a team to bring you the widest audio response and the nearest to natural listening as possible. Connected out this system will give you own speakers. Then the finished speaker system was tried and approved by side-by-side comparison with speaker systems selling for \$200.00. We think that its the most value that we have ever offered for the money. Ideal for use with any good audio system. (Impedance 4 ohms). Or, buy a matched pair for your Stereo Hi-Fi system. Mount them in any enclosure or use them just as they come. Features a Magnavox Alnico V 15" PM woofer, 12" Magnavox mid-range, 5" cone tweeter and 4 1/2" deep horn type cone tweeter. Speakers are matched; connected together with capacity-resistance to make each speaker do its share. Stock No. VOX-1512, 4-way speaker system. Sale price, \$29.95, 3 for \$87.95. Choice of blond or mahogany plastic grill cloth for above, \$1.25 extra. Response 20 to 22,500 C.P.S.



TREMEMENDOUS McGEE VALUE—NEW 1959 HI-FI SPEAKER SYSTEMS ON BAFFLE BOARDS

Model B-125-X, high fidelity 15-watt, 5-way speaker system, mounted on an 18" square baffle board. Has 12" high efficiency woofer, 3-way mid-range speakers, plus a 6" high-range and 3" 18 ohm tweeter. All with Alnico V magnets. Built-in crossover network with variable brilliance control. Ship, wt. 11 lbs. Stock No. B-125-X, 5-way, 15-watt Hi-Fi speaker system. AUDIOPHILE VALUE \$30.00. SALE PRICE \$18.95.

DELUXE HI-FI 25 WATT SPEAKER BOARD \$29.95

Model B-250-X, 4 matched Hi-Fi PM speakers mounted on a baffle board, 18" wide and 30" tall. For installation in your own cabinet or play as it comes. Features 15" woofer, 10" mid-range, 5 1/2" and 3" tweeters; built-in proper LC crossover network. All with Alnico V magnets. Built-in crossover network with variable brilliance control. Ship, wt. 11 lbs. Stock No. B-250-X, 4-way, 25-watt Hi-Fi speaker system. AUDIOPHILE VALUE \$30.00. SALE PRICE \$29.95.

over network. System is wired ready to connect to any FM-AM radio. 25 watts capacity, from 18 to 17,000 cps. AB matched for finest audio reproduction. \$50.00 list value. McGee's sale price, \$29.95.



Extra HI-FI—FINE IMPORTED 3-WAY AXIAL SPEAKERS

12TX-1 \$49.95

15TX-1 \$64.95

McGee offers extra value in these fine imported 12 and 15 inch, 3-way HI-FI PM speakers. Features heavy cast frames with woofer and mid-range diffusion type cones, separate driver and horn type tweeter, built-in crossover and tweeter volume control. American equal to these speakers are elsewhere. Our selling price.

Model 12TX-1, 12" HI-FI 3-way PM speaker. HI-FI in one speaker, 30 watts, response 30 to 16,000 cps. Woofer has 10,700 gauss, 18700 maxwell. Weight 13 lbs. Impedance 16 ohms. Sale price, \$49.95.

Model 15TX-1, 15" HI-FI 3-way PM speaker. 30 watts, from 25 to 16,000 cps. Woofer 10,400 gauss, 300,000 maxwell. Impedance 16 ohms. Weight 18 1/2 lbs. Sale price, \$64.95.

2-WAY 8 INCH COAXIAL \$12.95

Imported 8" coaxial PM speaker, \$12.95. Fine quality 8" coaxial PM speaker imported from Japan. Net weight, 3 lb. 6 oz. The 8" cone is corrugated, easy moving and shaped around the outer edge. The 3" tweeter adds brilliance to the highs, not obtainable from a single speaker. Dollar for Dollar a fine value. Response 40 to 16,000 cps. Alnico V magnet, 10,000 gauss. Impedance 8 ohms. Tweeter is capacity coupled. Stock No. PX-8A, Sale price \$12.95, 3 for \$35.00.



McGee's Famous 12 AND 15 INCH COAXIAL P. M. HIGH FIDELITY SPEAKERS

12-Inch \$12.95
15-Inch \$23.95

Model CU-14Y Model P15-CR

Model CU-14Y, 12" high fidelity coaxial PM speaker. Response from 30 to 17,000 cps. Full 6.5 oz. Alnico V magnet in the 12" woofer. Special coaxially suspended high frequency tweeter. Built-in crossover network. Only two wires to connect to your radio or amplifier. Matches 3.2 to 8 ohm output transformer. Don't confuse this speaker with many cheap speakers that are offered. This is a fine quality speaker. Stock No. CU-14Y. Sale price \$12.95 each, two for \$25.00.

Model P15-CR, 15" high fidelity coaxial PM speaker. Response down to 20 cps. and up to 17,000 cps. Full 11 1/2 oz. Alnico V magnet in the 15" woofer. Specially made, coaxially suspended 5" high frequency tweeter. Built-in crossover network. Only two wires to connect. Matches 3.2 to 8 ohm output transformer. A regular \$63.50 list speaker. Model P15-CR. McGee's Sale Price, \$23.95.

McGee's new 15" Junior coaxial PM speaker. 15" woofer has 6.8 oz. Alnico V magnet. 8" coaxially suspended tweeter with crossover. Only two wires to connect to any 8 ohm radio or amplifier. Frequency response from 40 to 16,000 cps. Model No. M15-CR, 15" Junior coax. PM speaker. Sale price, \$16.95.



HEAR BETTER-HI-FREQUENCY NEW 1959 MODEL 20-WATT SUPER TWEETER—\$35.00 List

\$12.95

McGee's 1959 Model imported 20 watt Super tweeter. Equals American tweeters with from \$25.00 to \$50.00 list price. Use with any woofer or attach to your present speaker. Simply couple through a 2 mfd. capacitor. Violins, pianos and all instruments above 1800 CPS sound more natural. Response from 1700 to 22,500 CPS. Down 20 db at 22,500 CPS. Smooth uniform response from 1700 to 16,000 cps. May be mounted in or used outside of your speaker baffle. V.C. impedance 8 ohms. Flux density 13,500 gauss. 32,500 Maxwell. Size, 4 1/2" x 2 1/2" x 3 1/2". Deep. All metal construction. Stock No. AT-3. McGee's Sale Price, \$12.95. Include 50¢ for postage. We recommend our AN-3 crossover.

NEW 1959 HI-FI SPEAKER IN ENCLOSURE

\$49.95

New 1959 model 4-way speaker system in a full size enclosure. Closed baffle 37" high, 27" wide and 23 1/2" front to back. Tone equal to high priced nationally advertised systems. Incorporates the same speakers as offered in the VOX-1512 system. On left, 25 watts, response 20 to 22,500 cps. Impedance 8 ohms. Equipped with plastic grill cloth. Illustrated with grill cloth removed to show speakers. Model McVOX-1512S4, Mahogany finish, \$49.95. Model McVOX-15122, Blond finish, \$64.95.



World Famous Imported from Holland NORELCO HI-FI PM SPEAKERS

12" Model 9762-M reg. \$59.97 Sale Price \$39.95

12" Model 9760 reg. \$32.97 Sale Price \$19.95

8" Model 9750 reg. \$22.17 Sale Price \$15.95

NORELCO Model 9762-12" wide range HI-FI PM speaker, res. 35 to 18,000 cps at 20-watts. Voice coil imp. 8 ohms—new Alnico VI magnet gives 11,000 gauss. Regular \$59.97 net, on sale at McGEE for only \$39.95.

NORELCO Model 9760-12" wide range HI-FI PM speaker, res. 25 to 18,000 cps at 20-watts. Voice coil imp. 8 ohms—new Alnico VI magnet gives 8,000 gauss. Regular \$32.97 net, on sale at McGEE for only \$19.95.

NORELCO Model 9750-8" wide range HI-FI PM speaker, res. 50 to 20,000 cps at 10-watts. Voice coil imp. 8 ohms—new Alnico VI magnet gives 5,000 gauss. Regular \$22.17 net, on sale at McGEE for only \$15.95.

NEW UNIVERSAL 3-WAY DIVIDING NETWORK \$12.95

It's simple to connect 2 or 3 speakers to this cross-over and feed them from any audio amplifier, input 8 to 16 ohms. Separate output connections for woofer, mid-range and tweeter. 3-way attenuation per octave. Crossover points 500 cps and 3300 cps. 6 pads built-in control. Instructions furnished for 2-way or 3-way speaker system. Metal case is finished in gold and black color. This imported crossover is equal to American made units that cost from \$19.00 to \$30.00. Stock No. AN-3, crossover network. McGee's Sale price, \$12.95.



Matched Woofer—Mid-Range—Tweeters



15 INCH 2 LB. MAGNET WOOFER \$26.95

McGee's new 1959 Model HF-15WX, 2 lb. Alnico V magnet woofer features an 8 ohm 3" voice coil. Cone is heavy molded construction with 3 1/2" reinforcing center button. An excellent woofer speaker. Use with any high fidelity audio amplifier. This woofer has a net weight of 16 lbs., 10 oz. Don't confuse it with some of the foreign made speakers that are light construction and just a few ounces. The material weight. This is an all American woofer. Two voices. Suggested factory list, \$26.95. McGee Sale price, \$26.95. Response, 30 cps to 5,000 cps. Rated 30 watts nominal, 35 watts peak. You could spend many more dollars and get a lot less speaker. Give your High-Fidelity Audio System the best.

8 INCH MID-RANGE \$49.95

McGee's new, 1959 Model Super-8, 8" mid-range PM speaker, A \$12.10 list value. Features heavy 6.5 oz. Alnico V magnet. One piece molded curved cone with small tweeter cone added. Will take from 4 to 12 watts audio. High fidelity response from 30 to 12,000 cps. 1" light weight aluminum bobbin voice coil, 8 ohms impedance. It will sound as good as speakers selling for up to \$18.00 per cone. McGee buys these speakers by the thousands and passes the savings on to you. Ideal for Hi-Fi music systems and all commercial sound installations. Stock No. SUP-8, super 8" PM speaker. \$12.10 list value. Your cost \$4.95, 2 for \$9.90. 4 inch Super cone tweeter. Extra heavy 6 oz. Alnico V ring magnet, heavy diaphragm, perforated metal in front of cone disperses high frequencies evenly. Response 1,000 to 18,000 cps. Use in pairs to give even and better audio reproduction. A pair of these will handle 30 watt of high frequency. Voice coil matches 4 to 8 ohms. Stock No. SUP-4TW. Sale price, \$4.95 each, 2 for \$9.90. Stock No. SUP-8-84XC. 4 way speaker hit includes HF-15WX woofer, SUP-8 mid-range and 2-4" SUP-4TW tweeters, plus 3-way crossover AN-3. Regular \$54.35 if bought separate. Sale price, \$40.95.

GET McGEE's 1959 CATALOG FREE

Mail Your Request Now. Fall Cat. 1959 Bargains. Hi-Fi, Electronic, Radio and TV Parts.

RCA Reg. \$11950 RADIATION COUNTER ON SALE AT McGEE for \$2995

RCA Model WF-10A, Radiation Geiger counter for amateur and professional use. Explore for Uranium or check for atomic fall-out radiation. Complete with test sample. Simple to use, weighs only 3 lbs. in aluminum case, 7 1/2" x 5 1/2" x 3 1/2". Indicates presence of radioactivity in 3 ways, by meter, neon light and headphones. Requires 2 Burgess 2X48 "B" batteries and 2 22 flashlight cells. Battery life, 99 hours. 3 sensitivity ranges, 0-100, 0-1000 and 0-10,000 counts per minute. A terrific value from McGee. RCA Model WF-10A with tubes and headphones, less batteries, \$29.95. Battery kit, \$5.25.

MODEL WF-12A Regular \$149.50—McGEE'S PRICE—\$34.95

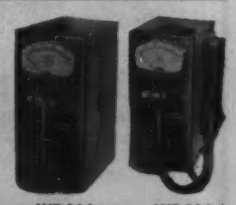
RCA Model WF-12A, Radiation Geiger counter. Similar to WF-10A, except has an external probe. Priced with tubes and headphones at \$34.95, less batteries. Kit of 2-XX48 Burgess "B" batteries and 2 22 flashlight cells, \$5.25 extra.

MODEL WF-11A Regular \$154.50—McGEE'S PRICE—\$37.95

RCA Model WF-11A, Radiation Geiger counter. Explore for Uranium or check for atomic fall-out. Uses extra sensitive Blawmuth tube. Test sample included. Simple to use, weighs only 3 lbs. Weatherproof case 7 1/2" x 5 1/2" x 3 1/2". Indicates presence of radioactivity in 3 ways, by meter, neon light and headphones. Requires 2 Burgess 2X48 "B" batteries and 2 22 flashlight cells. Battery life, 99 hours. 3 sensitivity ranges, 0-100, 0-1000 and 0-10,000 counts per minute. A terrific value. RCA Model WF-11A, Sale price, \$37.95 with tubes and headphones. Battery kit, \$5.25 extra. Similar size to WF-10.

RCA Model WF-15A (not illustrated). Has 10 sensitive tubes, 3 ranges to 100,000 counts per minute. Size, 11" x 4 1/2" x 7 1/2". Weight 8 lbs. Original price, \$475.00. McGee's Sale price, \$99.50. Battery kit, \$5.37 extra.

RCA Model WF-16A (not illustrated). Has 10 sensitive tubes, 3 ranges to 300,000 counts per minute. Size, 11" x 4 1/2" x 7 1/2". Weight 8 lbs. Original price, \$750.00. McGee's Sale price, \$149.50. Battery kit, \$5.37 extra.



WF-10A

WF-12A

McGEE RADIO COMPANY

September, 1958

PRICES F.O.B. KANSAS CITY
SEND 25% OR FULL
REMITTANCE WITH ORDER.
BAL. SENT C.O.D.
TELEPHONE VICTOR 2-5092
1903 McGEE ST., KANSAS CITY, MISSOURI

**NEW
OR
REPLACEMENT
THE
BIG
ANTENNA
PROFIT**



And the big name in rotation is

ALLIANCE TENNA-ROTOR

Critical Color-TV, channel changes, new stations—these are reasons why there's nothing like Alliance Tenna-Rotor for *lasting* customer satisfaction.

When you recommend and install an Alliance Tenna-Rotor you do the customer a favor and you boost your profits up into the big money class.

And it's easy to sell Alliance Tenna-Rotor because it's the leader. Customers know the name through years of consistent national advertising. Sell the name and idea first, then match the customer's budget with a model from the *complete* Alliance Tenna-Rotor line. You'll get plenty of sales helps and free ad mats to help build this profitable business. Write for complete dealer information.

The
ALLIANCE
Manufacturing Company
(Division of Consolidated
Electronics Industries Corp.)
Alliance, Ohio

alliance
TENNA-ROTOR



MOTOROLA: FOCUS CHANGE

If the focus-control potentiometer on any chassis in the TS-292 or TS-410 series should require replacement, it is advisable to check the circuit, since a simple change may prevent a recurrence. Refer to Fig. 1. Some chassis use a .005- μ fd. capacitor, C_m , which goes directly from pin 6 of the CRT (focus electrode) to ground. This should be removed from the circuit. In these chassis, the arm of the focus-

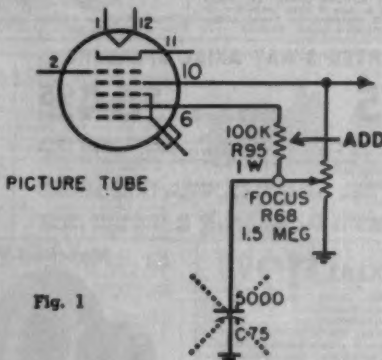


Fig. 1

control potentiometer will also be found directly connected to CRT pin 6. This connection is also removed and a 1-watt resistor, whose value is about 100,000 ohms, is wired between the potentiometer arm and the focus electrode, as shown in the illustration. Since the value of this resistor is not critical, units up to 150,000 ohms may be used provided they have the 1-watt rating.

MAGNAVOX VOLUME DROP

In 52-03 combination chassis, operation of the "Timbre Control" may produce an unusual symptom when the radio input selector is either in the AM or FM position. Rotation of the control in a counterclockwise direction may cause an abrupt drop in volume and also introduce hum. This is caused by the development of a spurious r.f. oscillation. This oscillation can be suppressed by the installation of a 10,000-ohm resistor in the circuit of the "Timbre Control." One end of the resistor connects to the junction of R_{211} and the arm of the control. The other end connects to C_{211} .

"SNIVETS" IN CAPEHART SETS

Although you will not find "snivets" in the dictionary, the symptom has caused much grief to service technicians. The term describes any spurious oscillation developing in the horizontal-output tube of a TV receiver that is radiated outward, picked up by the receiver's antenna input leads,



**BRITISH
ARE
COMING!**



This September, off the coast of Newport, R. I., Great Britain will try for the 17th time to take back the Cup won by the schooner "America" in 1851. The upcoming America's Cup Race, the first since 1937, has captured the imagination of the world.

It's no wonder! For rarely in history does a sports event come along with such color, tradition and excitement. British yachtsmen have invested more than \$20 million through the years to recapture "the ugly old mug" valued at \$100. This is the Race that has produced such great international sportsmen as Sir Thomas Lipton, T. O. M. Sopwith and Harold S. Vanderbilt.

To mark the occasion—dramatically and colorfully—POPULAR BOATING will publish a Special America's Cup Edition on August 26. You'll certainly want to read the Giant September issue, containing:

- Official rules of the America's Cup Race
- Accurate charts of the course to be run
- Beautiful full color reproductions of the contenders
- A detailed history of the competition
- Exclusive interviews with designers, builders and crew
- A daring prediction of the outcome of the Race

The best boating writers and photographers in the English-speaking world will make September POPULAR BOATING your personal guide to the momentous Race. Don't miss POPULAR BOATING's Special America's Cup Edition!

**ON SALE
EVERYWHERE
AUGUST 26—
ONLY 50c**



RADIO & TV NEWS

passed into the front end, and reproduced on the screen of the CRT. Generally it takes the form of one or more dark, ragged, vertical lines or bars interrupting the raster, although a variety of shapes is possible. It is more likely to be evident on weak signals or on u.h.f. reception. Occurrence and severity depend on differences in circuitry, output tubes, and signal level.

If "snivets" should occur on TV receivers using the CX-43 Capehart chassis, a modification in the screen circuit of the horizontal-output tube has been devised specifically to suppress

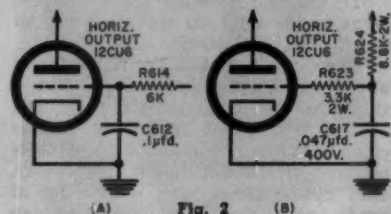


Fig. 2 (A) (B)

press the oscillation responsible for this symptom. The output tube's screen load resistor (R_{sl} , 6000 ohms, shown in Fig. 2A) is replaced by the series combination of R_{sl} (3300 ohms, 2 watts) and R_{ss} (8800 ohms, 2 watts). See Fig. 2B. One end of R_{ss} connects to the screen of the 12CU6 output tube, pin 4. The other end connects to R_{sl} . The original bypass capacitor, C_{ss} (.1 µfd.) is removed. The new bypass capacitor, C_{ss} (.047 µfd., 400 volts), is connected between the junction of the two resistors, R_{sl} and R_{ss} , at one end. The other end of the bypass is connected to ground.

VERTICAL SYNC. HOTPOINT

If you run into trouble with vertical sync stability on Models 14S206, 14S207, or any other using the Q-2 chassis, check the values of the resistors noted below and change them to conform with the values recommended for optimum stability: R_{122} should be 20 megohms, not 22 megohms; R_{123} should be 180,000 ohms, not 220,000 ohms; R_{124} should be 1.5 meg-

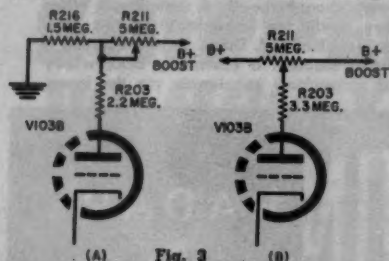


Fig. 3 (A) (B)

ohms, not 2.2 megohms; and R_{124} should be 33,000 ohms, not 22,000.

Changes made during production of this chassis include a somewhat different arrangement for the plate circuit of the vertical oscillator. The original wiring is shown in Fig. 3A, with the vertical control in the plate circuit connected between "B+" and ground through R_{124} . In later versions, R_{124} is eliminated (Fig. 3B) and control R_{124} is connected between boosted "B+" and regular "B+."

September, 1958

NEW!



TWO-SET COUPLER

delivers

MAXIMUM INTER-SET ISOLATION (12db-20db)

with

MINIMUM SIGNAL LOSS (3db)

New Model A-102 Two-Set Coupler delivers more signal to each VHF TV or FM set, with greater inter-set isolation than any other coupler in the field. The reason—a new original B-T circuit with a phase cancellation feature which automatically defeats interfering signals. No ghosts, no smears... ideal for color TV and FM. Housed in a smartly styled, weatherproof, molded, non-breakable case. Mounts easily indoors or outdoors—with or without concealing terminals.

List 2.95

THREE NEW B-T COUPLERS—4-SET HI-LO & UHF-VHF

Ideal for color, black and white, VHF, UHF and FM, these three new B-T couplers provide precise impedance match, lowest loss and maximum isolation. Housed in smartly styled, molded weatherproof cases.

A-104 FOUR SET COUPLER

Low loss 300 ohm directional coupler only 7 db insertion loss and 14-30 db inter-set isolation. Flat response 50 to 220 mc. Feeds 4 TV or FM sets from one antenna, or mixes 4 antennas into one line.

List 3.95

A-105 HI-LO ANTENNA COUPLER

Combines low band and high band VHF antennas or provides separate low and high outputs from a common line or antenna.

List 3.50

A-107 UHF-VHF ANTENNA COUPLER

Combines VHF and UHF antennas, or provides separate VHF and UHF outputs from a common line or antenna.

List 3.50

A-100 OUTDOOR MOUNTING KIT

Bracket and strap assembly for fast, easy mast mounting of models A-102, A-104, A-105, A-107.

List .90

These new B-T Couplers and a host of other quality engineered TV accessories are available at parts distributors. For further information write, Dept. RTN-9



BLONDER-TONGUE LABORATORIES, INC.

9 ALLING STREET

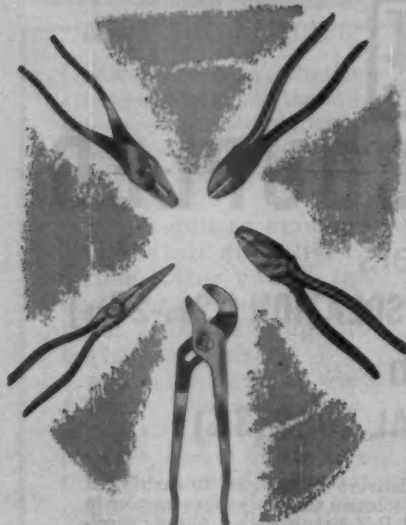
NEWARK 2, N. J.

UHF Converters • Amplifiers • TV Systems • Industrial TV Cameras

You'll

DO THE JOB EASIER WITH THE RIGHT PLIER

CHAN NEL LOCK



*Full Polish Finish
Quality Pliers*

Any job is a hard job without the right tools. These special purpose Channellock quality pliers will help you do hundreds of jobs easier, faster. They're precision-built of high grade drop forged steel to last longer, work better. And you'll like the gleaming, full-polished finish at no extra cost.

Ask for Genuine Channellock pliers by name.
Look for the trademark on the handle.

CHAMPION D'ARMENT TOOL COMPANY
MEADVILLE, PENNSYLVANIA

Mac's Service Shop

(Continued from page 68)

"People are funny, to coin a phrase; but I know from experience that at least four out of five customers will not take the set away when the facts are presented to them in this fashion.

"Even if he doesn't leave it, you have suffered no real loss. For a service shop to gain a reputation for doing good work at reasonable prices is a good thing, but to get a reputation for 'working cheap' never really helped any shop—not in the long run."

"You know, I think the toughest thing of all to handle are requests for credit," Barney offered. "In spite of signs all over the place saying that service work is strictly cash, we still get these. What makes it really hard is that quite likely, in many cases, there is no intent to chisel. A lot of people just ask for credit sort of automatically."

"Yes, I know what you mean," Mac said; "but a strictly cash policy must have no exceptions if it is to be effective. In this case, the exception proves there is no rule—not really. You notice that new customers seldom give us any trouble in this respect. It is easy for them to understand that we cannot be asked to trust them since they are unknown to us. But when an old customer or, worse yet, a friend says, 'How about my paying for this Friday?' that really puts the pressure on the strictly cash policy."

"Yeah, but I've seen you handle that one more than once," Barney remarked.

"That's right. I explain quite truthfully that our bookkeeping system is

set up for a strictly cash operation and that there is absolutely no provision for a credit arrangement. Then, if it is a friend or someone in whom I have confidence, I suggest that I will make them a personal loan so that they can pay Miss Perkins for the set and keep our records straight. I have never lost a dime this way. It's kind of funny, but people who would let a bill owed the shop drag on and on will show up promptly Friday to pay back the money I let them have out of my own pocket."

"Do you think we lose some business because we don't do service work on tick?" Barney asked.

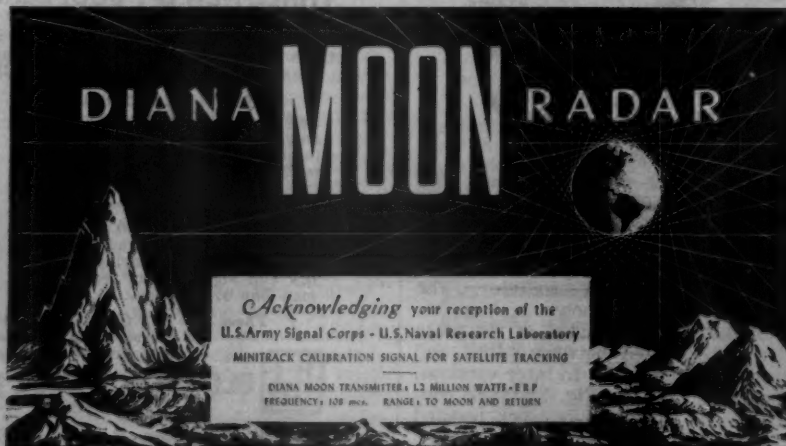
"Certainly I do, but I'm not worried about it. Maybe I'm wrong, but I think in the long run we come out ahead. I've talked to lots of technicians who tried to make a go of independent service and failed. Invariably, they closed their doors with a lot of credit on their books; and you can imagine how much of that was ever collected after the business failed. Every time someone walks out or hangs up when I say that our strictly cash policy means exactly what it says and I feel a little low about it, I just remember these failures and determine to keep right on as we have been doing. Say, what are you grinning about?"

"I was just thinking what a switch this conversation has been from some of the magazine articles I've read," Barney said. "They are always telling the readers how to keep the radio service shop from gypping them, and here we have been talking about how to keep the public from chiseling the service technician. Personally, I find it a delightful and refreshing change!"

"So do I," Mac said; "so do I!"

-50-

Amateur radio operators who successfully pick up signals from outer space during calibration of the satellite-Minitrack stations can now show cards acknowledging their reception. Before launching of U. S. satellites, the giant transmitter and antenna of the Diana moon radar at the U. S. Army Signal Research and Development Laboratory at Fort Monmouth bounce 108-mc. signals off the moon. This is done so that the far-flung Minitrack stations and amateur radio operators can calibrate their receivers for precise tuning to the transmitters aboard the U. S. satellites. When hams receive the moon-bounced signals, they notify the Laboratory at Fort Monmouth or the American Radio Relay League at West Hartford, Conn. In appreciation of their assistance, the Army sends each reporting amateur a customary acknowledgment or QSL card—the first one ever issued for picking up signals via the moon.



Superior's New
Model 82

RAPID TESTER

The Very Best Value in
Multi-Socket Tube Testers!



Production of this Model was delayed a full year pending careful study by Superior's engineering staff of this new method of testing tubes. We don't expect it to replace conventional testers but if you want to try this new type of tester, you can do no better than mail the coupon below. Don't let the low price mislead you! We claim Model 82 will outperform similar looking units which sell for much more—and as proof, we offer to ship it on our examine before you buy policy.

Primarily, the difference between the conventional tube tester and the multi-socket type is that in the latter, the use of an added number of specific sockets (for example, in Model 82 the noval is duplicated eight times) permits elimination of element switches thus reducing testing time and possibility of incorrect switch readings.

To test any tube, you simply insert it into a numbered socket as designated, turn the filament switch and press down the quality switch—THAT'S ALL! Read quality on meter. Inter-element leakage, if any indicates automatically.

FEATURES:

- ★ Dual Scale meter permits testing of low current tubes.
- ★ 7 and 9 pin straighteners mounted on panel.
- ★ All sections of multi-element tubes tested simultaneously.
- ★ Use of 22 sockets in improved circuit permits testing over 600 tube types and prevents possible obsolescence.
- ★ Ultra-sensitive leakage test circuit will indicate leakage up to 5 megohms.
- ★ Employs new type 4" air-damped meter resulting in accurate vibrationless readings.

\$36⁵⁰

Superior's New
Model TW-11

STANDARD PROFESSIONAL TUBE TESTER



• Tests all tubes, including 4, 5, 8, 7, Octal, Lock-in, Hearing Aid, Thyatron, Miniatures, Sub-miniatures, Novals, Sub-minors, Proximity fuse types, etc. • Uses the new self-cleaning Lever Action Switches for individual element testing. Because all elements are numbered according to pin-number in the RMA base numbering system, the user can instantly identify which element is under test. Tubes having tapped filaments and tubes with filaments terminating in more than one pin are truly tested with the Model TW-11 as any of the pins may be placed in the neutral position when necessary. • The Model TW-11 does not use any combination type sockets. Instead individual sockets are used for each type of tube. Thus it is impossible to damage a tube by inserting it in the wrong socket.

• Free-moving built-in roll chart provides complete data for all tubes. All tube listings printed in large easy-to-read type.

• NOISE TEST: Phono-jack on front panel for plugging in either phones or external amplifier will detect microphonic tubes or noise due to faulty elements and loose internal connections.

EXTRAORDINARY FEATURE

• SEPARATE SCALE FOR LOW-CURRENT TYPES—Previously, on standard emission type tube testers, it has been standard practice to use one scale for all tubes. As a result, the calibration for low-current types has been restricted to a small portion of the standard scale. The extra scale used here greatly simplifies testing of low-current types.

The Model TW-11 operates on 105-130 Volt 60 Cycles A.C. Comes housed in a beautiful hand-rubbed oak cabinet complete with portable cover.

\$47⁵⁰

Superior's New
Model TV-12

TRANS-CONDUCTANCE TUBE TESTER



ALSO TESTS TRANSISTORS!

TESTING TUBES

- ★ Employs improved TRANS-CONDUCTANCE circuit. An in-phase signal is impressed on the input section of a tube and the resultant plate current change is measured. This provides the most suitable method of simulating the manner in which tubes actually operate in Radio & TV receivers, amplifiers and other circuits. Amplification factor, plate resistance and cathode emission are all correlated in one meter reading.
- ★ NEW LINE VOLTAGE ADJUSTING SYSTEM. A tapped transformer makes it possible to compensate for line voltage variations to a tolerance of better than 2%.
- ★ SAFETY BUTTON—protects both the tube under test and the instrument meter against damage due to overload or other form of improper switching.
- ★ NEWLY DESIGNED FIVE POSITION LEVER SWITCH ASSEMBLY. Permits application of separate voltages as required for both plate and grid of tube under test, resulting in improved Trans-Conductance circuit.

TESTING TRANSISTORS

A transistor can be safely and adequately tested only under dynamic conditions. The Model TV-12 will test all transistors in that approved manner, and quality is read directly on a special "transistor only" meter scale.

The Model TV-12 will accommodate all transistors including NPN's, PNP's, Photo and Tetraodes, whether made of Germanium or Silicon, either point contact or junction contact types.

Model TV-12 housed in handsome rugged portable cabinet sells for only

\$72⁵⁰

SHIPPED ON APPROVAL NO MONEY WITH ORDER — NO C.O.D.

We invite you to try before you buy any of the models described on this and the following page. If after a 10 day trial you are completely satisfied and decide to keep the Tester, you need send us only the down payment and agree to pay the balance due at the monthly indicated rate. (See other side for time-payment schedule details.)

**NO INTEREST
OR FINANCE**

CHARGES ADDED!

If not completely satisfied, you are privileged to return the Tester to us, cancelling any further obligation.

SEE OTHER SIDE!

Cut out and mail TODAY!

All prices net, F.O.B., N.Y.C.

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Permit No. 61430

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3849 TENTH AVENUE

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Superior's New
Model 76

ALL-PURPOSE BRIDGE

IT'S A

✓ CONDENSER BRIDGE ✓ RESISTANCE BRIDGE
✓ SIGNAL TRACER ✓ TV ANTENNA TESTER



SPECIFICATIONS:

CAPACITY BRIDGE SECTION—4 Ranges: .00001 Microfarad to 1000 Microfarads. Will also locate shorts, and leakages up to 20 megohms. Measures the power factor of all condensers from .1 to 1000 Microfarads. (Power factor is the ability of a condenser to retain a charge and thereby filter efficiently.)

RESISTANCE BRIDGE SECTION—2 Ranges: 100 ohms to 5 megohms. Resistance can be measured without disconnecting capacitor connected across it. (Except, of course, when the R C combination is part of an R C bank.)

SIGNAL TRACER SECTION—With the use of the R.F. and A.F. Probes included with the Model 76, you can make stage gain measurements, locate signal loss in R.F. and Audio stages, localize faulty stages, locate distortion and hum, etc. Provision has been made for use of phones and meter if desired.

TV ANTENNA TESTER SECTION—Loss of sync. snow and instability are only a few of the faults which may be due to a break in the antenna, so why not check the TV antenna first? 2 Ranges: 2' to 200' for 72 ohm coax and 2' to 250' for 300 ohm ribbon.

Model 76 comes complete with all accessories including R.F. and A.F. Probes; Test Leads and operating instructions. Nothing else to buy. Only

\$26⁹⁵

Superior's New
Model 77

VACUUM TUBE VOLTMETER

WITH NEW 6" FULL-VIEW METER!



AS A DC VOLTMETER—Will measure any voltage up to 1500 volts with negligible loading. Indispensable in receiver and Hi-Fi Amplifier servicing and a must for Black and White and color TV servicing where circuit loading cannot be tolerated.

AS AN AC VOLTMETER—Will quickly and simply measure RMS value if sine wave, and peak-to-peak value if complex wave. Pedestal voltages that determine the "black" level in TV receivers, sync pulses and saw tooth voltages are easily read.

AS AN ELECTRONIC OHMMETER—Because of its wide coverage of measurement in the resistance range (from .2 ohms to 1,000 megohms) the Model 77 will be your most frequently used resistance meter. Leaky capacitors show up glaringly when tested with the Model 77.

SPECIFICATIONS

DC VOLTS—0 to 3/15/75/150/300/750/1500 volts at 11 megohms input resistance.

AC VOLTS (RMS)—0 to 3/15/75/150/300/750/1500 volts.

AC VOLTS (Peak to Peak)—0 to 8/40/200/400/800/2000 volts.

ELECTRONIC OHMMETER—0 to 1000 ohms/10,000 ohms/100,000 ohms/1 megohm/10 megohms/100 megohms/1,000 megohms.

DECIBELS—-10 db to +18 db, +10 db to +38 db, +30 db to +58 db. All based on 0 db=.006 watts (6 mw) into a 500 ohm line (1.73v).

ZERO CENTER METER—For discriminator alignment with full scale range of 0 to 1.5/7.5/37.5/75/150/375/750 volts at 11 megohms input resistance.

Model 77 comes complete with operating instructions, probe, test leads and carrying case. Operates on 110-120 volt 60 cycle. Only

\$42⁵⁰

Superior's New
Model 79

SUPER- METER

WITH NEW 6" FULL-VIEW METER!



A Combination VOLT-OHM MILLIAMMETER
• Plus CAPACITY, REACTANCE, INDUCTANCE AND DECIBEL MEASUREMENTS • Also Tests SELENIUM AND SILICON RECTIFIERS, SILICON AND GERMANIUM DIODES.

SPECIFICATIONS

• D.C. VOLTS—0 to 7.5/15/75/150/750/1,500.
• A.C. VOLTS—0 to 15/30/150/300/1,500/3,000.
• D.C. CURRENT—0 to 1.5/15/150 Ma. 0 to 1.5/15 Amperes.

• RESISTANCE—0 to 1,000/100,000 Ohms. 0 to 10 Megohms.

• CAPACITY—.001 to 1 Mfd. 1 to 50 Mfd.
• REACTANCE—50 to 2,500 Ohms, 2,500 Ohms to 2.5 Megohms.

• INDUCTANCE—.15 to 7 Henries, 7 to 7,000 Henries.
• DECIBELS—-6 to +18, +14 to +38, +34 to +58.

The following components are all tested for QUALITY at appropriate test potentials. Two separate BAD-GOOD scales on the meter are used for direct readings.

• All Electrolytic Condensers from 1 MFD to 1000 MFD.
• All Selenium Rectifiers. • All Germanium Diodes.
• All Silicon Rectifiers. • All Silicon Diodes.

Model 79 comes complete with operating instructions and test leads. Use it on the bench—use it on calls. A streamlined carrying case included at no extra charge accommodates the tester, instruction book and test leads. Only

\$38⁵⁰

SHIPPED ON APPROVAL NO MONEY WITH ORDER—NO C.O.D.

MOSS ELECTRONIC DISTRIBUTING CO., INC.
Dept. D-404, 3640 Tenth Ave., New York 34, N. Y.

Please send me the units checked. I agree to pay down payment within 10 days and to pay the monthly balance as shown. It is understood there will be no finance or interest charges added. It is further understood that should I fail to make payment when due, the full unpaid balance shall become immediately due and payable.

- | | |
|---|---|
| <input type="checkbox"/> Model 82..... Total Price \$36.50
\$6.50 within 10 days. Balance \$6.00
monthly for 5 months. | <input type="checkbox"/> Model 76..... Total Price \$26.95
\$6.95 within 10 days. Balance \$5.00
monthly for 4 months. |
| <input type="checkbox"/> Model TW-11..... Total Price \$47.50
\$11.50 within 10 days. Balance
\$6.00 monthly for 6 months. | <input type="checkbox"/> Model 77..... Total Price \$42.50
\$12.50 within 10 days. Balance
\$6.00 monthly for 5 months. |
| <input type="checkbox"/> Model TV-12..... Total Price \$72.50
\$22.50 within 10 days. Balance
\$10.00 monthly for 5 months. | <input type="checkbox"/> Model 79..... Total Price \$38.50
\$8.50 within 10 days. Balance \$6.00
monthly for 5 months. |

Name.....
Address.....
City..... State.....

All prices net, F.O.B., N.Y.C.

We invite you to try before you buy any of the models described on this and the preceding page. If after a 10 day trial you are completely satisfied and decide to keep the Tester, you need send us only the down payment and agree to pay the balance due at the monthly indicated rate.

NO INTEREST OR FINANCE CHARGES ADDED!

If not completely satisfied, you are privileged to return the Tester to us, cancelling any further obligation.

SEE OTHER SIDE!

◀ Cut out and mail TODAY!

Realistic Profit Margins

(Continued from page 64)

cut-rate drugs. Let's wise up! Any fool can sell a tube over the counter.

"Suppose all service shops were to sell tubes at a 65 per-cent mark-up over cost. In a competitive market for name-brand merchandise, this represents a good profit and is considered good business. But it is more important to look at what we gain.

"If tubes were available to customers locally at a 65 per-cent mark-up, the drugstores, hardware stores, and supermarkets would have to drop their prices to meet this competition. This would take away that beautiful 150 per-cent profit we have created for these operators to split between themselves and the stores and chop it down to a realistic 65 per-cent. After deducting the cost of amortizing the tube testers, the losses due to pilferage, etc., there would hardly be enough left after the split to cover the cost of shipping. As a result, the tubes and testers would disappear from the scene."

Other dealers have met the incursion of self-service tester competition head-on by making their own shops self-service centers. The more successful dealers who tried that approach went all out in promoting their self-service facilities. Their merchandising programs included store front modernization, redecoration of the shop interior to focus attention on the do-it-yourself facilities, and the addition of other products that set owners need for other home repairs.

There has not been, however, any widespread recognition in the service industry of the basic economic factors involved in the renewed trend toward do-it-yourself servicing. The challenge to service is that it must learn how to merchandise its facilities in a manner that will make the general public feel it is getting a full dollar of value for every dollar that is spent for electronic service.

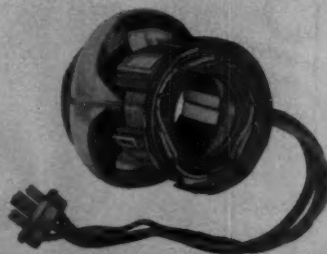
More than 4000 bits of information can be stored on this five-inch-square "memory frame" being produced by RCA for a new high-speed electronic computer used by the Atomic Energy Commission. The frame is composed of thin strands of insulated copper wire and tiny ferrite cores, 83,000 of which would weigh just a pound.



SUITS NEED PRESSING— MERIT DEFLECTION YOKES DO NOT!

Merit deflection yokes are cosine wound TO FORM,
not pressed. Pressing can lead to distortion and
poor focusing. Pressing after winding frequently
causes breakdown.

MERIT COILS AND TRANSFORMERS HAVE
"BUILT-IN" ADVANTAGES.



Each Merit yoke is
100% LIVE TESTED



COMPARE IT WITH MERIT

MERIT COIL AND TRANSFORMER CORP
MERIT PLAZA · HOLLYWOOD, FLORIDA



James Melton
makes his tape recordings on

irish
ferro-sheen
recording
tape

That alone is not the reason
why you should use

irish
ferro-sheen
recording
tape

Here's why you should use

irish
ferro-sheen
recording
tape

It's the best-engineered tape
in the world...

...gives you better highs...better lows...
better sound all around! Saves your tape
recorder, too—because the **irish FERRO-SHEEN**
process results in smoother tape
...tape that can't sand down your mag-
netic heads or shed oxide powder into your
machine. Price? Same as ordinary tape!



Available wherever quality tape is sold.
ORRadio Industries, Inc., Opelika, Alabama
Export: Morhen Exporting Corp., New York, N. Y.
Canada: Atlas Radio Corp., Ltd., Toronto, Ontario

122



REAR-SEAT SPEAKER KIT
Oxford Components, Inc., 556 W.
Monroe St., Chicago 6, Ill. is now



marketing a low-priced rear-seat
speaker kit which has been trade-
named the "Satellite."

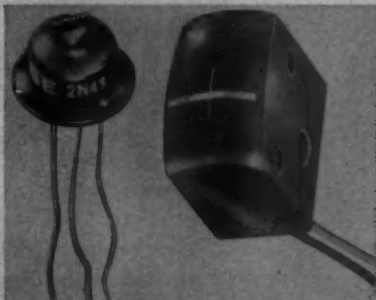
The kit comes individually boxed in
a multi-colored container which is de-
signed to be used as a display unit as
well. The kit includes a 6" x 9" or
5" x 9" speaker of rugged construction,
chrome-plated switch plate and grille,
and three-position slide switch. The
speaker kit comes complete with all
mounting hardware.

The "Satellite" is a universal model
which will fit all makes and models of
cars.

D.C. ERASE HEAD

Michigan Magnetics, Inc. of Ver-
montville, Mich. is now in production
on a new d.c. erase head which pro-
vides 50 db erasure with 5.5 ma. of
current through the coil.

This head is currently being manu-
factured in a 20 mil track width con-
figuration. A mating playback-record
head will be available shortly. For



details on this unit, shown above be-
side a transistor for size comparison,
write the manufacturer direct.

"NEOPHONIC" UNIT

The Electronic Sales Corporation of
America (TESCOA), 1820 W. Ganson
St., Jackson, Mich. is now marketing a
compact unit which is designed to pro-

vide a stereo effect from a monaural
program source when connected be-
tween two separate amplifiers and
their associated speakers.

Tradenamed the "Neophonic," the
new device is designed to operate from
a 12-watt (max.) amplifier. When con-
nected into a hi-fi system as directed,
the device allows the volume control on
amplifier No. 1 to control the volume
on both channels. Balancing is handled
by the volume control on the second
amplifier.

For additional details on this device,
write the distributor direct.

WEATHERPROOF SPEAKER

Atlas Sound Corporation, 1449 39th
Street, Brooklyn 18, N. Y. is now



marketing a rugged hi-fi weatherproof
speaker for voice and music, as the
"Coax-Projector" Model WT-6.

Two individual drivers and two in-
dividual horns, with built-in electronic
crossover, are combined in a single
weatherproof housing. The low fre-
quencies are reproduced by a high
efficiency woofer properly loaded with
a folded exponential horn. The high
frequencies are reproduced by a wide-
angle tweeter completely protected
against all climate and humidity con-
ditions.

The unit will handle 15 watts and
has a depth of 11" and a bell opening
measuring 15". For full information,
write the manufacturer.

HARMAN-KARDON STEREO LINE

Harman-Kardon, 520 Main St., West-
bury, N. Y. has announced a series of
stereo units which will be available for
the fall market.

"The Duet" (Model T-224) is a stereo
tuner with separate channels for the
reception of AM and FM signals in
stereo broadcasting. A jack in the rear
makes the unit readily adaptable for
multiplex reception. The companion
stereo amplifier is being marketed as

RADIO & TV NEWS

"The Trio" (Model A-224). Its circuit incorporates a stereo preamp and two separate 12-watt power amplifiers on a single chassis. There are separate ganged treble and bass controls, a balance control, mode switch, speaker selector switch for local and remote speaker systems, contour control, tape output for recording applications, and a rumble filter.

The units are housed in matching enclosures with brushed copper escutcheons and black cages.

Other equipment in the stereo line includes a dual stereo preamp, two AM/FM monaural tuners for providing the second channel for those already



owning a monaural tuner, a stereo amplifier with dual 25-watt power channels, and a single unit which incorporates both an FM and AM stereo tuner and dual stereo preamps on a single chassis.

Complete details on any or all of these units are available from the manufacturer. A data sheet on the "Dual" and "Trio" models is available on request.

E-V "WOLVERINE" SERIES

Electro-Voice, Inc. of Buchanan, Mich. is now offering a series of popular-priced components which is being marketed as the "Wolverine" line.

The line includes hi-fi speakers, enclosures, and mid-range and high-frequency kits. There are 8- and 12-inch coaxial speakers, three enclosures, a mid-range driver and crossover, and a high-frequency driver and crossover to allow the customer to expand to two- or three-way systems, now or in the future.

The enclosures are offered in along-the-wall, corner, and bookshelf models. Two of the complete systems can be



used for stereo applications at a price of many single systems, according to the company. The "Lindon," a bookshelf model, is shown in the photograph.

The company will supply a complete data sheet on the entire "Wolverine" line to those making a direct request.

"STEREO-PHASE SELECTOR"

Vidaire Electronics Mfg. Corp. of Baldwin, N. Y. has recently added a stereo-phaser selector to its line of hi-fi and audio accessories.

September, 1958

OSCILLOSCOPE COURTESY OF PRECISION APPARATUS COMPANY, INC.



...but a
NORELCO® speaker
made me

LISTEN!

Every time I bought a record, I used to set up the calibrated microphone, connect the oscilloscope, start the music with bated breath, and—consumed with anxiety—I would keep my eyes glued to the screen of the cathode ray tube. If anything on the 'scope pattern looked suspicious (something always did), I would start checking tubes, voltages and crossover frequencies, and examine the record grooves under a microscope.

Then, at the house of a musician friend, I heard a NORELCO loudspeaker in a NORELCO enclosure. I was suddenly carried away by the sheer joy of listening! What lovely sound! Clean, tight bass; creamy smooth highs; crisply defined middles... the strings went la-lah-de-dah; the kettledrums went dum-de-dum... it was music!

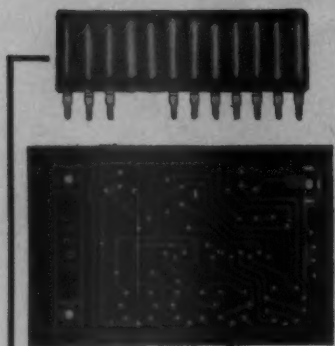
I rushed out of my friend's house to the nearest hi-fi dealer, bought my own NORELCO speaker, took it right home with me... and I am a different person today. Man, just listen to that music!

(You can change your hi-fi life, too—just write to North American Philips Co., Inc., High Fidelity Products Division, 230 Duffy Avenue, Hicksville, Long Island, N. Y.)

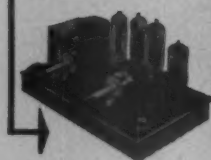


NORELCO offers you a line of 5" to 12" high-fidelity speakers and acoustically engineered enclosures.

When Converting Your Phono to Stereo...Use



The ERIE AUDIO-AMPLIFIER KIT featuring "PAC" and an ERIE Printed Wiring Board



MODEL
PAC-AMP-1

With these Plug-In Components:

- ERIE "PAC" (Pre-Assembled Components)
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- OUTPUT TRANSFORMER
- FILTER CAPACITOR
- VOLUME CONTROL and SWITCH
- TUBE SOCKETS
- CAPACITORS
- TONE CONTROL
- TUBES

SPECIFICATIONS FOR ERIE STANDARD AUDIO-AMPLIFIER

- Frequency Response: 30 cycles to 12,000 cycles ± 0 , -3.5 db.
- Sensitivity: 0.56 volt RMS (input of 1 KC) for 2 watt output.
- Power Output: 2 watts • Input Impedance: 2 megohms.
- Output Impedance: 4 ohms • AC Power Consumption: 17 watts.
- Overall Dimensions: $6\frac{1}{2}''$ L \times $4\frac{1}{2}''$ W \times $3\frac{1}{2}''$ H • Shipping Weight: 2 lbs.

See and hear it at
your local distributor
or Write for
nearest source.

ERIE

Electronics Distributor
DIVISION
ERIE RESISTOR CORPORATION
P.O. BOX 100
MILWAUKEE, WIS.

The Model SP-5 was designed to simplify phasing each speaker in a multiple speaker installation. In addition, it will perform the following functions: switch monaural and stereo signals into the same amplifiers and speakers; switch broadcast stereo and stereo tape or disc signals into the same amplifiers and speakers; and switch broadcast stereo, stereo tape or disc and monaural signals into the same amplifiers and speakers.

The unit plate is gold embossed brass for mounting on the hi-fi panel. It comes complete with matching hardware and installation instructions.

STEREO TAPE DECK

Webster Electric Co. of Racine, Wis. has just introduced a new stereo tape deck which was developed for the "do-it-yourself" enthusiast as well as for audiophiles who wish to modernize their present hi-fi setups.

The "Ekotape 340" is controlled by means of two knobs. With accessories, the unit can record or play back stereo as well as monaural program material. The circuit features the company's special "monomatic" central control which eliminates tape loops. The "on-off" switch and speed control have been



combined to neutralize the drive mechanism when the machine is turned off.

The company is also offering a companion stereo record-playback preamp for use with the new tape deck. It provides a tone and volume control center, with knobs and meters for each channel.

For full specifications on the deck and its preamp, write direct to the manufacturer.

"KNIGHT-KIT" 18-WATT AMPLIFIER

Allied Radio Corporation, 100 N. Western Ave., Chicago 80, Ill. has just released a new 18-watt amplifier in its "Knight-Kit" line.

Featuring the use of an exclusive printed-circuit switch and two printed circuit boards, construction is greatly simplified for kit builders since most of the complex wiring is already completed.

Employing RCA's new 6973 audio output tubes, the amplifier delivers a full 18 watts output at only 5 per cent distortion. Hum level is better than 60 db below rated output and frequency response at 18 watts is ± 1 db from 20 to 30,000 cps.

Eight inputs are provided on the amplifier for every possible signal source, including NARTB-equalized tape head input. A total of seven record equalization settings are offered plus tape head

LEARN

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Norelco
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AUDIO TAPE
Full Line of
Cabinets

**Save on Hi-Fi, Ham Radio,
other Electronics Devices by
using Easy-to-Assemble Kits!**



**New ELECTRONICS KITS Guide
and Directory on Sale Soon!**

NOW—for the first time—you can get a 160-page guide that tells you all you need to know about putting together kits for your own hi-fi set, electronics laboratory, short-wave receiver, electronics accessories for car and boat, photoelectric eyes, pocket radios—and dozens of other electronics devices!

The new ELECTRONICS KITS is a windfall of valuable information—with 30 construction articles and 640 illustrations. PLUS a complete Directory listing all available electronics kits, including specifications, prices, and manufacturer's names.

This big, new builder's guide and directory to ELECTRONICS KITS goes on sale in October. Reserve your copy now at your newsstand or radio parts store—only \$1.00.

ZIFF-DAVIS PUBLISHING CO.
434 So. Wabash Ave., Chicago 5, Ill.

equalization. Other controls include separate bass and treble tone controls and "on-off-volume."

The metal case housing is styled in French gray and ebony black and



measures 4" high, 13" wide, and 8" deep. The kit comes complete with case, all parts, wire, solder, tubes, and "step-and-check" assembly instructions.

CROSSOVER NETWORK

The Electronics Division of Van Norman Industries, Inc., 186 Granite St., Manchester, N. H. has developed and is marketing a new crossover which is designed to be used with separate bass and treble amplifiers in a hi-fi system. The Model XO-1000 divides the frequency spectrum to eliminate noise and hum.

The crossover point is at 800 cps, dividing the spectrum into two regions most compatible with the characteristics of modern electromagnetic and electrostatic speakers.

The "Vantron" crossover is tubeless, simple to install and to use. The outputs are connected directly to the
(Continued on page 126)

**CONVERT
YOUR TAPE RECORDER TO
STEREO**



PLAYBACK AMPLIFIER

Here's fast the amplifier for that "second" stereo sound channel. The Nortronics PL-100 Playback Amplifier is a compact high quality 8-watt amplifier with ample gain to match any phono cartridge or high impedance magnetic tape head. Variable equalization includes NARTB and RIAA standards. **Audiophile Net \$39.50.**



RECORDING AMPLIFIER

The Nortronics RA-100 Recording Amplifier supplies any magnetic recording head with audio power, bias voltage, and also power for an erase head. It has NARTB equalization, record-level meter, and monitoring jack. Two RA-100's are ideal for stereo recording. **Audiophile Net \$49.50.** Nortronics stereo accessories are available from your dealer, or write for information. (Canadian Representative: Active Radio & TV Ltd., 88 Spadina Ave., Toronto, Canada.)

THE NORTRONICS COMPANY, INC.
1017 E. Sixth Street Minneapolis 4, Minnesota



New Autospeed Changer



ASR-433 Stereo Amplifier—Selected for display at the Vienna International Fair



New Slimline Speaker

THE NEW STROMBERG-CARLSON COMPONENTS

Integrity in music

Integrity in Music, as applied to high fidelity components, means reproduction which adds nothing to, or takes nothing from, the original performance.

Our choice of this slogan is no accident. Just as your purchase of a component system is not a casual investment, our attitude toward the manufacture of components is very serious. Each piece of gear must reflect the highest possible achievement of engineering, production, and musical skill. Yes, musical skill—because the guiding minds of the Stromberg-Carlson component group are those of electronic and acoustic engineers with extensive musical training.

The musical sound of our new components was the final critical test before they were made available to you.

We will be glad to submit our specifications to your critical judgment.

"There is nothing finer than a Stromberg-Carlson"

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336 West Monroe Street
Chicago 6, Illinois

Illustrated literature
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OXFORD 3-WAY SPEAKER SYSTEMS and BASS REFLEX CABINETS

Enhance the beauty and comfort of your room while you enhance the sound of your high fidelity. Every room will sparkle with these OXFORD cabinets whether for stereo or in a setting with just one cabinet. Here is double-duty design... cabinets can be used for horizontal or vertical positioning... with use of tapered legs or runners which are both supplied. Available with or without OXFORD 3W20 3-way speaker systems, to give you the best sound reproduction.

Cabinet Model No.	Audiophile Net.
SR-1M Red Mahogany	\$117.00
SR-1C Cherry	117.00
SR-1B Blonde Oak	117.00
Complete 3-way speaker system for above cabinets Model 3W20	\$ 39.00

F.O.B. Factory



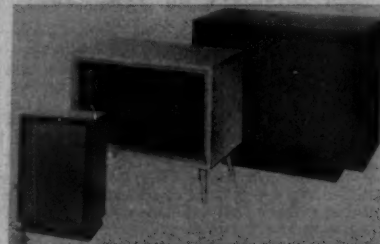
woofer and tweeter main amplifiers, the input to the preamplifier. Simple adjustment of the bass and treble controls can then be made to achieve aural balance.

For complete specifications, write the manufacturer direct.

NEW NORELCO SPEAKERS

North American Phillips Company, Inc. 230 Duffy Ave., Hicksville, N. Y. has a new line of enclosures on the market that feature a removable base which permits the cabinets to be placed horizontally or vertically to fit in with any room arrangement or decor.

While primarily designed for use with the firm's speakers, the FRS enclosures work equally well with most other speakers. The enclosures are of the



ducted-port type and each model is decorator styled in a choice of walnut, blonde, or mahogany. All cabinets are lined with sound absorptive materials for correct damping.

The Models FRS I and FRS III come with a removable base while the Model FRS II is supplied with legs. The Model I is designed to handle 12" speakers while the Model II comes with an insert baffle for 8" speakers and will handle both 8" and 12" units.

Further information on any or all of these enclosures is available from the High Fidelity Products Division of the company.

"POW-R-CHECK" METER

The Electronics Division of Van Norman Industries, Inc., 186 Granite St., Manchester, N. H. is now offering a power output meter designed especially for the hi-fi enthusiast.

The "Vantron" Model PC-1000 monitors power output while reproducing music or speech on a precision logarithmic scale which makes 1/10th watt as readable as a 10-watt indication. It incorporates an accurate db scale suitable for use with a standard tone-modulated phonograph record to check such intrinsic sound values as treble and bass control positions, flat over-all operation, loudness-control frequency response, relative speaker system efficiency, and response of the phono cartridge.

TAPE CONVERSION KITS

The Nortronics Co., Inc., 1011 S. Sixth St., Minneapolis 4, Minn. has announced the availability of two new stereo kits for the conversion of existing tape recorders to stereo.

The Model SK-100 allows reproduction of standard half-track, 2-channel stereo tapes on present tape recorders

STEREO or MONAURAL



DYNAKIT

**PROVIDES COMPLETE
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The Dynakit **PREAMPLIFIER**

- ★ Lowest Distortion and Noise
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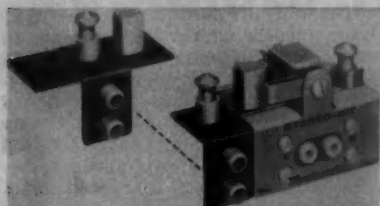
The Dynakit **STEREO CONTROL**

- ★ Adds Complete Stereo Control To Two Preamps Without Noise or Distortion
- ★ Unique Blend Control Fills In "Hole In Middle"
- ★ Level, Balance, Loudness, Channel Reverse, and Dual Tape Monitor Controls
- ★ Only \$12.95 Net

Descriptive literature available on request

DYNACO, INC., 617 No. 41st St., Phila. 4, Pa. Export Division
25 Warren St., New York, N. Y.

of the monaural variety while the Model SK-50 provides for the newer quarter-track, 4-channel tapes. Either



unit may be used for the playback of monaural tapes. Both units come completely assembled and wired.

Both of the "Stereo-Kits" contain a factory aligned TLD magnetic head. Erase-Kits for either of the heads are available as the Model EK-100 (2-channel) and Model EK-50 (4-track) at extra charge.

The manufacturer will supply additional details on these kits on request.

STEREO DISC CONVERSION

Electrovoz Co., Inc., 60 Franklin St., Orange, N. J. is now offering its "Walco" all-purpose stereo conversion kit for present mass-market phonographs.

The kit comes with a four-watt push-pull auxiliary amplifier for the stereo



channel, two tone controls, a separate auxiliary loudspeaker in a specially baffled cabinet, and a four-wire ceramic stereo pickup cartridge which readily adapts to most existing tone arms and replaces the monaural cartridge used in the conventional record player.

AUDIO SYSTEM ANALYZER

Winston Electronics, Inc., 4312 Main St., Philadelphia 27, Pa. is now in pro-



duction on a portable audio system analyzer which is being marketed as the "Win-Tronix Model 800."

The instrument is designed for testing and servicing all hi-fi, stereo, and other audio systems. It incorporates the functions of six instruments, including an audio v.t.v.m., audio signal generator, audio output wattmeter with speaker loads, IM distortion

Garrard models change. Garrard ideals do not. Meaningful new features are added. Time-proven features are carefully retained. Gadgets, for the sake of gadgetry, are sternly rejected. The all-important fact to remember is that thirty-five years of experience in designing, testing, and building fine record players, guide us in offering you the present Garrard models.

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Each speed variable!
Each unit with its own performance test report. \$89.50

Model TPA/10 TRANSCRIPTION TONE ARM
Professional performance, precise construction and exceptional stability. \$34.50

Model T Mark II 4-SPEED MANUAL PLAYER
A superior unit for quality budget systems. \$32.50

Model RC38 4-SPEED SUPER AUTO-MANUAL CHANGER
Continuous 4 or 8" variable control on all speeds. \$67.50

Model RC38 4-SPEED DELUXE AUTO-MANUAL CHANGER
Exclusive pusher platform protects your records. \$64.90

Model 121/11 INTERMIX AUTO-MANUAL CHANGER
Fine performance with economy and compactness. \$42.90

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NEW!

24 Page Handbook is your fact-file on all Bell Components



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Before you buy any hi fi system, you'll want to have Bell's new high fidelity handbook. It answers all your questions... helps you decide which hi fi system is right for your home. Easy to understand. A handy pocket reference guide when you shop for Bell High Fidelity.

Some of the many interesting features of Bell's New Hi Fi Handbook:

- How to start your hi fi system
- Questions and answers about Stereo
- 31 Photographs of all Bell components
- List of all specifications and features

With your FREE copy of Bell's High Fidelity Handbook we'll send you the names of the Bell dealers where you can hear a demonstration of Bell High Fidelity.

Bell Sound Systems, Inc.
355 Marion Road
Columbus 7, Ohio

RM-1

Please RUSH free copy of Bell High Fidelity Handbook.

NAME _____

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CITY _____

STATE _____

meter, harmonic distortion meter, and db and noise meter. All tests may be made with only two cable connections.

A data sheet providing complete specifications and price is available from the manufacturer on request.

AUDIO CATALOGUES

TAPE HANDBOOK

Robins Industries Corp., 36-27 Prince St., Flushing 54, N. Y. has just issued a 24-page handbook for the professional and amateur tape recordist.

Entitled "Tape Editing and Splicing" and written by N. M. Haynes, the book outlines ways of getting more use and enjoyment from a tape recorder. The text covers splicing techniques, geometry of the splice, splice detection, localization, editing procedures, spliceless editing, etc. Line drawings and actual photographs of the material under discussion help to clarify the proper procedures.

The material included in this handy little volume was excerpted from the author's volume "Elements of Magnetic Tape Recording," published last year by Prentice-Hall.

For those who want a pocket-sized reference manual on tape splicing and editing, this little booklet would appear to be a bargain at 25 cents a copy from the company.

SELECTING STEREO EQUIPMENT

A useful guide to the selection and placement of stereo sound equipment has been issued by *Electro-Voice, Inc.* of Buchanan, Michigan as a service to audiophiles and music enthusiasts.

Written in easy-to-understand form, the booklet outlines five factors requisite for listening satisfaction, explains the principles of stereo reception from various sound sources, discusses the placement of speakers for maximum enjoyment, stereo discs and their reproduction, connecting and matching amplifiers, etc.

Equipment made by the company is used as examples but the principles involved are universal. Copies of this brochure are available from the manufacturer.

ENDLESS-LOOP RECORDER DATA

Amplifier Corp. of America, 398 Broadway, New York 13, N. Y. has

issued a four-page folder which describes in some detail its "Magne-loop" series of continuous-loop magnetic tape recorder-reproducers.

The brochure describes features of 21 basic models which are available in single- or dual-speeds as well as in single-, dual- and triple-channels. Recording characteristics are tabulated for easy reference. A complete variety of playback modes are suggested and made available to accommodate specialized uses and technical applications. Mechanical and electrical features are fully covered.

ASA TAPE STANDARDS

The American Standards Association, 70 E. 45th St., New York 17, N. Y. has copies of the new international standard on the interchangeability of magnetic tape recordings available for \$2.40 each.

Recommended by the International Electrotechnical Commission (IEC) the standard is entitled "Recommendations for Magnetic Tape Recording and Reproducing Systems: Dimensions and Characteristics." The recommended standard applies to non-perforated magnetic tape and equipment used for sound recordings and sound reproduction in both professional and domestic applications. Among the specifications established are the mechanical and electrical requirements of recording and sound reproducing equipment, nominal tape speed and tolerance, position of the active surface of the tape, position and dimension of the magnetic sound track, and spools.

The IEC standards are not mandatory but are the recommendations to the 34 member countries.

AMERICAN MICROPHONE CATALOGUE

American Microphone Manufacturing Company, 412 S. Wyman St., Rockford, Ill. has issued a new 16-page catalogue which describes in detail its full line of microphones, handsets, phono cartridges and arms, mobile equipment, and accessories.

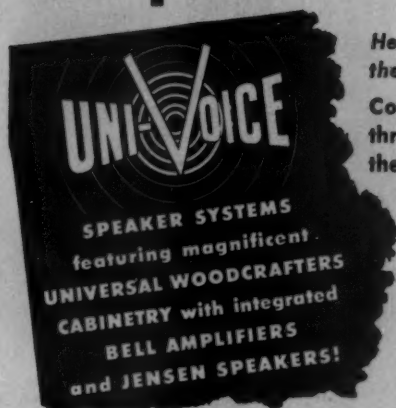
Available without charge on request, Catalogue 58 includes photographs, specification charts, and sound distribution patterns on each microphone as well as physical specifications and performance data on other items in the line.

Radio Shack Corporation of Boston takes no stock in "recession rumors" for it has just announced an expansion program which will add 80,000 square feet of warehouse, office, and mail order facilities; created 50 new jobs; opened a second store in Boston; and increased its advertising and promotion budget. The new building, located at 730 Commonwealth Ave. in uptown Boston, brings to a total of 131,000 square feet the space occupied by this Boston-New Haven distributor.



RADIO & TV NEWS

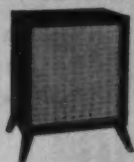
Complete New High-Fidelity Package!



Here is the **FINEST STEREO CONVERSION SYSTEM**... the finest **BASIC HI-FI SYSTEM** (just add any turntable)
Constructed of heavy 7-ply furniture veneer throughout and priced so that everyone can afford the **UNI-VOICE HIGH FIDELITY PACKAGE!**

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Other 3 Speaker and 2 Speaker packages available, also without amplifier.
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Here is our crowning design achievement to provide a new experience in thrilling Hi-Fi sound from any record player, radio tuner or tape recorder.

Each fiber-glass loaded cabinet contains newly developed speaker components which are specially engineered for the **UNI-VOICE SYSTEM** by Jensen, the country's leading speaker manufacturer... PLUS specifically adapted 10 watt Hi-Fi amplifier by BELL, world renowned for quality.

NOW... you get performance unknown until now in the popular price field... WITH EXCEPTIONAL **LARGE MARK-UP** for PROFITABLE SALES!

Illustrated is Model **AUV-35**
High Fidelity Package
UV-35 3 speaker system
with Bell Amplifier... **\$149.50**
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Write for new multi-colored literature.



Universal WOODCRAFTERS inc.
of LA PORTE, Indiana

The Nation's Largest Cabinet Specialists
to the Radio, TV and Hi-Fi Industry

New G-E "Golden Classic" stereo-magnetic cartridge



"GOLDEN CLASSIC" Model GC-7 (shown above) with .7 mil diamond stylus **\$23.95***

"GOLDEN CLASSIC" Model GC-5 (for professional-type tone arms) with .5 mil diamond stylus **\$26.95***

"STEREO CLASSIC" Model CL-7 with .7 mil synthetic sapphire stylus... **\$16.95***
*Manufacturer's suggested resale prices

For matchless reproduction, use with G.E.'s new "Stereo Classic" tone arm. Write for complete specifications. Ask for a demonstration at your dealer's soon. General Electric Company, Specialty Electronic Components Dept., Section 58, W. Genesee St., Auburn, N. Y.

**makes stereo a practical reality
—at a very realistic price!**

- Compatible with both stereo and monaural records
- Full frequency response, 20 through 20,000 cycles
- "Floating armature" design for increased compliance and reduced record wear. Effective mass of stylus approximately 2 milligrams
- High compliance in all directions—lateral compliance 4×10^6 cm/dyne; vertical compliance 2.5×10^6 cm/dyne
- Recommended tracking force with professional-type tone arm 2 to 4 grams
- Consistently high separation between channel signals. (Specifications for Model GC-5 with .5 mil diamond stylus.)

GENERAL  ELECTRIC



I'd Like to Recommend THE hallicrafters "2 and 6" SR-34 TRANSCEIVER

World's First Complete 2 & 6 Meter
Radio Station with Transistorized,
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FREE 1959 CATALOG

Designed for either AM or CW, the SR-34 operates on 115V AC, 6V DC or 12V DC, with instantaneous voltage selection and also "crossbanding" between the 2 and 6 meter bands. The transmitter is crystal-controlled; up to four crystals may be switch-selected. Fifth position permits external VFO operation. Band selection is front panel controlled. Receiver is double conversion superb, with quartz crystal controlled second oscillator, offering outstanding selectivity and high image rejection. Highest stability through separate oscillator and RF sections for each band. 8-meter, BFO, AM, etc., provided. Power output: 6-7W on 2 meter, and 7-10W on 6 meter AM or CW, 100% modulated negative peak clipping.

Same as above but with 115V AC power supply, and less whip antenna and carrying cover: \$399.00.

Just off the press, this colorful new catalog contains hundreds of bargains for the amateur, hi-fi enthusiast, experimenter and dealer-serviceman. Send for yours right now.



Please send me Free Catalog . . . and complete info on the Hallicrafters line. RTV-4

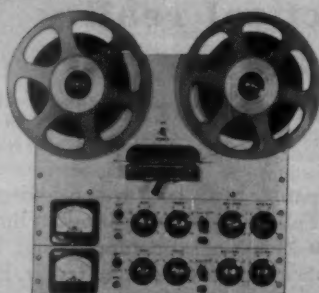
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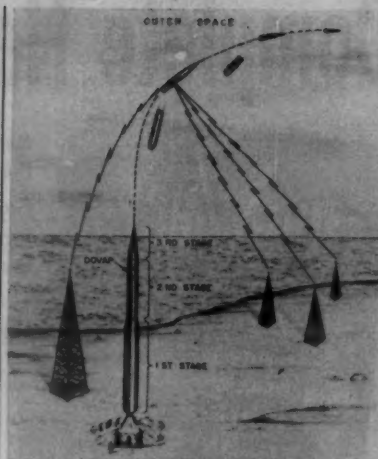
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—Recording Quality For 4 Track Slightly Less—

For Complete Information Write To:

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Dept. RN-9 Elkhart, Indiana



Ground transmitter (left) feeds questioning signals to DOVAP, which retransmits them to three other ground antennas that are located in triangular pattern.

ROCKET-RIDER RADIO

Miniature radio, known as
DOVAP, answers scientists'
queries on Vanguard flight.

A RUGGED two-way radio about the size of a loaf of bread will play a part in the launching of the Navy's second Vanguard satellite. The self-contained unit, known as DOVAP (Doppler, Velocity, and Position), is produced by International Telephone and Telegraph Corp.

The 10-pound radio will send back continuous information to U. S. scientists on the performance of the first and second stages of the Vanguard missile. Powered by tiny wet cells, DOVAP defines the trajectory and velocity of the two stages during flight and relays vital information on fuel consumption, electrical power, and atmospheric conditions.

Before dropping to earth inside its second-stage carrier, the radio signals that the third-stage rocket and satellite are riding parallel to the earth and ready to orbit. This information is obtained through use of the Doppler principle. Comparison of radio signals transmitted to the missile and retransmitted by DOVAP to three ground stations provide coded data which is translated by high-speed computers to confirm the success or failure of a satellite launching.

The Vanguard DOVAP has been used successfully in high-altitude research studies by IGY scientists at Fort Churchill, Canada, and it will be used later this year at Guam for high-altitude IGY wind experiments. —30—

RADIO & TV NEWS



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Send for Lafayette's 1959 Catalog—the most complete, up-to-the-minute electronic supply catalog crammed full of everything in electronics at our customary down-to-earth money-saving prices.

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The most complete selection and largest stocks of hi-fi components and systems—available for immediate delivery at the lowest possible prices. Save even more on Lafayette endorsed "best-buy" complete systems.

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NEW!



**Lafayette
TRANSCRIPTION PLAYER
WITH 3 LB. 12"**

ALUMINUM TURNTABLE

Professional 4-speed player ideally suited for stereo. Has magnetic eddy-current brake permitting $\pm 10\%$ speed variation. Amazingly low priced! Shpg. wt., 14 lbs.

PK-240 Net **37.50**

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STEREO BALANCE METER

Dual audio output level indicator with two meters, for comparing audio levels. Ideal for balancing hi-fi stereo systems.

TM-40 Net **8.95**

NEW!

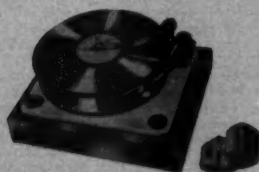


LAFAYETTE-GOODMANS 12" 3-WAY SPEAKER

- 30 WATTS
- FREQUENCY RESPONSE 30-20,000 CPS
- PLUG-IN 12 DB/OCTAVE CROSSOVER NETWORK WITH LEVEL CONTROL

Custom-built by Goodmans of England with 1 1/2 lb. Alcomax 8 Magnet. Features axially mounted, free-edged wide range woofer, stiff-coned mid-range radiator and compression-driver tweeter.

SK-110 Net **47.50**
Two for Stereo Net **89.00**



NATIONALLY ADVERTISED 4-SPEED AUTOMATIC RECORD CHANGER

Famous brand latest model with new GE GC-7 Magnetic Compatible Stereo Cartridge with diamond stylus. Guaranteed to please or money refunded! Regular \$9.50 Value! Shpg. wt., 21 lbs.

PK-251—(less Wood base) Net **39.50**

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20,000 ohms per volt DC and 10,000 ohms per volt AC instrument. Hand-held, weighs only 10 oz! Clear plastic face cover. Has 22 most used ranges selected by single switch. With batteries and leads. Shpg. wt., 1 lb.

AR-660 Net **22.50**

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KT-500
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New! Years Ahead!

LAFAYETTE STEREO TUNER KIT

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\$7.45
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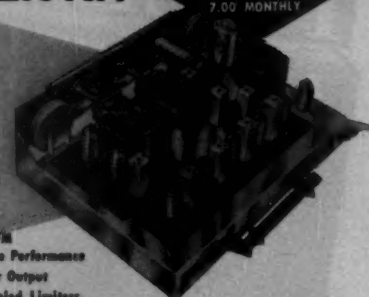


Use it as a Binaural-Stereophonic
FM-AM tuner

Use it as a Dual-Monaural
FM-AM tuner

Use it as a straight Monaural
FM or AM tuner

THE MOST FLEXIBLE TUNER EVER DESIGNED



- Multitap Output for New Stereo FM
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- Separately Tuned FM and AM Sections
- 12 Tuned Circuits
- Dual Cathode Follower Output
- Armstrong Circuit with FM/AF and AFC Defeat
- Dual Double-Tuned Transformer Coupled Limiters.

More than a year of research, planning and engineering went into the making of the Lafayette Stereo Tuner. Its unique flexibility permits the reception of binaural broadcasting (simultaneous transmission on both FM and AM), the independent operation of both the FM and AM sections at the same time, and the ordinary reception of either FM or AM. The AM and FM sections are separately tuned, each with a separate 3-gang tuning condenser, separate flywheel tuning and separate volume control for proper balancing when used for binaural programs. Simplified accurate knife-edge tuning is provided by magic eye which operates independently on FM and AM. Automatic frequency control "locks in" FM signal permanently. Aside from its unique flexibility, this is, above all else, a quality high-fidelity tuner incorporating features found exclusively in the highest priced tuners.

FM specifications include grounded-grid triode low noise front end with triode mixer, double-tuned dual limiters with Foster-Seely discriminator, less than 1% harmonic distortion, frequency response 20-20,000 cps $\pm 1/2$ db, full 200 kc bandwidth and sensitivity of 2 microvolts for 30 db quieting with full limiting at one microvolt. AM specifications include 3 stages of AVC, 10 kc whistle filter,

built-in ferrite loop antenna, less than 1% harmonic distortion, sensitivity of 5 microvolts, 8-kc bandwidth and frequency response 20-5000 cps ± 3 db.

The 5 controls of the KT-500 are FM Volume, AM Volume, FM Tuning, AM Tuning and 3-position Function Selector Switch. Tastefully styled with gold-brass execution having dark maroon background plus matching maroon knobs with gold inserts. The Lafayette Stereo Tuner was designed with the builder in mind. Two separate printed circuit boards make construction and wiring simple, even for such a complex unit. Complete kit includes all parts and metal cover, a step-by-step instruction manual, schematic and pictorial diagrams. Size is 13 1/4" W x 10 1/2" D x 4 1/2" H. Shpg. wt., 22 lbs.

The new Lafayette Model KT-500 Stereo FM-AM Tuner is a companion piece to the Models KT-300 Audio Control Center Kit and KT-400 70-watt Basic Amplifier Kit and the "Triumvirate" of these 3 units form the heart of a top quality stereo hi-fi system.

KT-500 Net **74.50**

LT-500 Same as above, completely factory wired and tested..... Net **124.50**

NEW! LAFAYETTE STEREO/MONAUROAL BASIC POWER AMPLIFIER KIT

- 36-WATT STEREO AMPLIFIER-18-WATTS EACH CHANNEL
- FOR OPTIONAL USE AS 36-WATT MONAUROAL AMPLIFIER
- EMPLOY'S 4 NEW PREMIUM-TYPE 7189 OUTPUT TUBES
- 2 PRINTED CIRCUIT BOARDS FOR NEAT, SIMPLIFIED WIRING
- RESPONSE BETTER THAN 35-30,000 CPS $\pm 1/2$ DB AT 18 WATTS
- LESS THAN 1% HARMONIC OR INTERMODULATION DISTORTION



KT-310

47.50

ONLY 4.75 DOWN
5.00 MONTHLY

A superbly-performing basic stereo amplifier, in easy-to-build kit form to save you lots of money and let you get into stereo now at minimum expense! Dual inputs are provided, each with individual volume control, and the unit may be used with a stereo preamplifier, for 2-18 watt stereo channels or, at the flick of a switch, as a fine 36-watt monaural amplifier — or, if desired, it may be used as 2 separate monaural 18-watt amplifiers! CONTROLS include 2 input volume controls, channel Reverse switch (AB-BA), Monaural-Stereo switch. DUAL OUTPUT IMPEDANCES are: 4, 8, 16 and 32 ohms (permitting parallel (monaural) operation of 2 speaker systems of up to 16 ohms. INPUT SENSITIVITY is 0.45 volts per channel for full output. TUBES are 2-6AN6, 4-7189; GZ-34 rectifier. SIZE 9-3/16" x 10-9/16" with controls x 5 1/4" x 13 1/4" W. Supplied complete with perforated metal cage, all necessary parts and detailed instructions. Shpg. wt., 22 lbs.

KT-310 Stereo Power Amplifier Kit Net **47.50**

LAFAYETTE MASTER AUDIO CONTROL CENTER

with BINAURAL CHANNEL AND DUAL VOLUME CONTROL.

- Self-Powered
- DC On All Filaments
- 24 Positions of Equalization
- Tape Head Input, High Impedance
- Dual Cathode Follower Output Stages

This is not only the finest hi-fi preamp characterized by unmatched features, but it has been functionally designed to keep pace with the conversion of your present hi-fi system to binaural (Stereophonic) sound. Incorporates an extra channel and dual volume control for binaural reproduction. Features include DC on all tube filaments, negative feedback in every stage, dual cathode follower output stages and latest printed circuit construction. Less than 0.01% THD distortion and less than 0.07% harmonic distortion at 1V. Hum and noise level better than 80 db below 3V. Uniformly flat frequency response over entire audible spectrum. 7 inputs for every type of phone, tuner or tape. Tasteful styling, brilliantly executed. Size 12 1/4" x 9 1/4" x 3 1/4". Shpg. wt., 10 1/2 lbs.

KT-300—Lafayette Master Audio Control Kit Complete with cage and detailed assembly instructions..... Net **39.50**

LT-30—Same as above completely wired and tested with cage and instruction manual. Net **59.50**

DELUXE 70 WATT BASIC AMPLIFIER

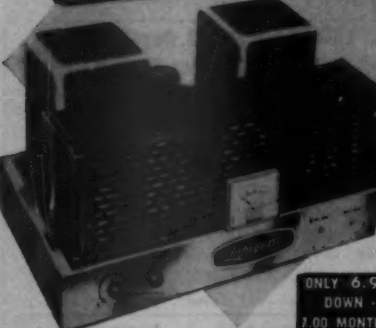
- Conservatively Rated At 70 Watts • Inverse Feedback • Variable Damping
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- Here's ultra-stability in a 70 watt basic power amplifier employing highest quality components conservatively rated to insure performance and long life. Features matched pair KT 88's and wire range linear Chicago output transformer, variable damping control, meter for bias and balance and gold finish chassis. Frequency response 10-100,000 cps ± 1 db. Hum and noise 90 db below full output. THD distortion less than 1 1/2% at 70 watts, less than 0.3% below 30 watts. Harmonic distortion less than 2% at 70 watts from 20 to 20,000 cps ± 1 db. Output impedance 4, 8 and 16 ohms. Handsome decorative cage perforated for proper ventilation. Size 14 1/2" x 10 x 7 1/4" including cage and knobs. Shpg. wt., 40 lbs.

KT-400—Lafayette 70 watt Deluxe Basic Amplifier Kit complete with cage and detailed assembly instructions..... Net **69.50**

LA-70—Same as above completely wired and tested with cage and instruction manual. Net **94.50**



KT-300
IN KIT
FORM
39.50



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AN IDEAL QUALITY SYSTEM FOR LISTENING

TO THE NEW HIGH-REALISM STEREO SOUND!

For Stereo & Monaural Reproduction



COMPONENTS

Lafayette LA-90 28-Watt Stereo Amplifier	72.50
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Lafayette PK-111 Wood Base	3.95
GE GC-7 Stereo Magnetic Cartridge	23.47
2-Lafayette SK-58 Coaxial 12" Speakers	59.00
Total Reg. Price	200.57

ONLY 16.75 DOWN — 12.00 MONTHLY

A superb phono music system brought to you by Lafayette to help you get started in stereo. Heart of the system is the new Lafayette LA-90 with 14 watts per channel and with all the inputs necessary for a complete stereo control center. Other fine components of the system are the famous new Garrard RC121/II 4-speed automatic record changer ready to accept stereo cartridges, the Lafayette PK-111 wood base for changer, of fine selected woods; the new GE GC-7 stereo/monaural variable reluctance cartridge with 0.7 mil genuine GE diamond stylus; and 2 of the unbeatable, for performance-value, Lafayette SK-58 12" coaxial speakers with built-in crossover network and brilliance level control. Supplied complete with cables, connectors, and easy-to-install instructions. Shpg. wt., 66 lbs.

HF-374 Stereo Phono System, with mahogany or blonde wood changer base (please specify)	Net 167.50
HF-375 Same as HF-374 but with 2-Lafayette CAB-16 mahogany or walnut or CAB-17 blonde Resonator-type speaker enclosures (specify which)	Net 222.50

LAFAYETTE STEREO FM/AM-PHONO MUSIC SYSTEM

Same as HF-374 above but with new Lafayette stereo Model LT-99 FM/AM Tuner.

HF-376 Stereo FM/AM-Phono System	Net 237.00
HF-377 Same as HF-376 but with 2-Lafayette CAB-16 mahogany or walnut or CAB-17 blonde speaker enclosures	Net 292.00

**YOU PAY ONLY 167.50
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NEW! LAFAYETTE 30-WATT STEREO AMPLIFIER

Superlative Features and Low Cost make it easy to GO STEREO NOW!



LA-90 72.50

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- 28 WATTS MONAURALLY WITH 1 OR 2 SPEAKER SYSTEMS
- 14 WATTS PER STEREO CHANNEL
- SPEAKER PHASING SWITCH
- 3.5 MILLIVOLTS SENSITIVITY FOR TAPE HEAD OR PHONO CARTRIDGE
- 20-20,000 CPS RESPONSE

A new, versatile stereo control center preamplifier-amplifier whose excellent performance and low cost make it easy to start enjoying stereo sound right now! Power output is 14 watts per channel for stereo, or—by placing the Stereo-Monaural Switch in "Monaural" position and connecting the output transformer taps in parallel—28 watts are available to drive a single speaker system monaurally; or—each individual amplifier output may be connected to a separate speaker system for 28-watts total monaural output with the amplifier used as either an electronic crossover, feeding low frequencies to 1 speaker system and highs to the other, or to create a pseudo-stereophonic effect with monaural program material. Response is 20-20,000 cps; distortion is below 1 1/2% at 12 watts; hum is 75 db below full output, either channel; output taps are 8, 16, and 32 ohms (4, 8 or 16 ohms when strapped together); controls include 6-position selector switch (Aux, Ceramic or Crystal, Tuner, LP-RIA, POP, Tape Head), Balance Channel A, Balance Channel B, Master Level, Treble A and Treble B (dual concentric), Bass A and Bass B (dual concentric), Channel Reverse Switch, Stereo-Monaural Switch, Tape Monitor Switch, Speaker Phasing Switch. Inputs include dual Tuner, Crystal/Ceramic, Mag. Phono, Tape Head, Tape Monitor Output. Tubes are 4-12AX7, 4-EL84, 2-EZ80 Rectifiers. Size is 4-11/16" h x 14-9/16" w x 9-1/4" d. Shpg. wt., 22 lbs.

LAFAYETTE LA-90 Stereo Amplifier

Net 72.50

NEW! LAFAYETTE STEREO MONAURAL FM-AM TUNER

FLEXIBLE DESIGN! LOW BUDGET PRICE! INSTALL STEREO NOW!



LT-99 72.50

**ONLY 7.25 DOWN—
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- FM-AM STEREO RECEPTION
- FM OR AM MONAURAL RECEPTION
- FM MULTIPLEX RECEPTION (REQUIRES DECODER)
- FOR SIMULTANEOUS FM & AM LISTENING IN DIFFERENT ROOMS
- 3 MICROVOLTS FM SENSITIVITY
- ARMSTRONG FM CIRCUIT
- AUTOMATIC FREQUENCY CONTROL

An excellent unit with many outstanding features whose low cost and high degree of flexibility combine to make it practicable to enjoy stereo FM/AM broadcasts NOW without fear of obsolescence. The Lafayette LT-99 Stereo Tuner may be used for standard AM or FM (monaural) or for FM-AM stereo listening. Or, you can use it as a 2-channel receiver and feed FM to one room and AM to another at the same time. Outputs are provided for stereo or monaural tape recording directly off the air. Styling is modern and designed to please the style-conscious modern young homemaker.

Circuitry is of the Armstrong FM type, with limiter and discriminator; sensitivity is 3 microvolts (on FM) for 20 db quieting, 75 microvolts loop sensitivity on AM; frequency response is, for FM, 20-20,000 cps \pm 1 db, and for AM 20-5,000 cps \pm 2 db; output voltages are FM—216 volts for 100% modulation, AM—1 volt average. Output jacks include AM-FM Monaural, AM Stereo, AM Tape Recording, FM Tape/Multiplex. Controls include Stereo-Monaural switch, Selector Switch (AM, FM-AFC, FM, Off), AM Tuning, FM Tuning, Multiplex-Tape switch. Built-in FM and AM antennas. Tubes are 6BE6, 2-6BA6, 6U8, 12AT7, 6AU6, 6AL5; diode AM detector, selenium rectifier. For 105-120 volts, 50/60 cps AC. Size 8-1/2" d x 13-5/16" x 4-1/4" h. Shpg. wt., 16 1/2 lbs.

LAFAYETTE LT-99 Stereo Tuner

Net 72.50

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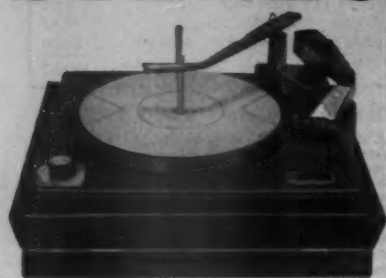
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GLASER- STEERS GS-77

the modern record changer

When it comes to the selection of a record changer to meet the exacting requirements of both modern stereo and modern high fidelity monaural records — there is only one choice, the GS-77.

From the day this modern record changer was born, strict adherence to rigid precision standards and advanced engineering made it the ideal high fidelity record changer. Now, new features have been added to make it the ideal stereo changer. An easily accessible stereo-monaural switch directs the stereo signal to the proper speaker. On monaural records, it provides a signal to both speakers adding extra depth. A double channel muting switch assures complete silence at all times except when the stereo record is being played. New GS-77 quick-change cartridge holder makes it easy to change from stereo to monaural cartridge with the turn of a knob.

Other GS-77 features assure the finest reproduction, stereo or monaural. The tone arm exhibits no resonance in the audible spectrum, and virtually eliminates tracking error. The arm counterbalance is so designed that stylus pressure between the first and tenth record in the stack does not vary beyond 0.9 gram. These characteristics virtually eliminate vertical rumble — to which stereo is sensitive. Turntable pause eliminates the grinding action which takes place where records are dropped on a moving turntable or disc — protecting the delicate stereo record grooves.

The GS-77 is the perfect record changer for stereo as it is for monaural high fidelity. \$59.50 less cartridge and base. At hi-fi dealers, or write: Glaser-Steers Corp., 20 Main St., Belleville 9, N. J. RTN-9
In Canada: Alex L. Clark, Ltd., Toronto, Ontario. Export: M. Simons & Sons Co., Inc., N. Y. C.

Certified RECORD REVIEW

By BERT WHYTE

I AM writing this about three weeks before I leave for Chicago to attend the convention of the National Association of Music Merchants. As I have noted in these pages before, this is the place where the stereo disc gets more or less "officially" launched. Quite obviously, after that time, stereo discs will be the subject of reviews and given the same attention as their monaural counterparts.

As most readers are aware, there have been a trickle of stereo discs from a number of the small independents and I have managed to get my hands on a few of the stereo discs that will be issued by the major labels. I have not reviewed them, for a number of reasons. First and foremost, I don't feel that what I hear can be classed as representative of the type of stereo disc sound that will be offered after the NAMM convention. This is not necessarily meant in a derogatory sense. In fact, I would go so far as to say that some of these present recordings, being virtually "hand-made," with a lot of time and patience lavished on them, may sound much better than the run-of-the-mill production stuff. It is also true that I have heard some incredibly poor material passed off as stereo discs.

Out of the convention will undoubtedly emerge a median level of the quality we can expect from a stereo disc, as well as outstanding individual quality discs. My own feeling as regards reviews of stereo discs is that, whenever possible, the stereo disc should be compared to its monaural disc and stereo tape counterparts. At least, this type of review should be used until all the "bugs" have been ironed out of stereo discs and they have reached a certain uniform level of acceptable quality. Of course, if the stereo disc never had any previous issue as a monaural record or a stereo tape, this would have to be an exception. Maybe I'm all wet, in this thinking, but I feel there is a need for the comparative review approach in the early stages of the stereo disc. Your comments on this question would be welcome and I'll go along with the majority on how stereo discs should be reviewed.

FALLA

MASTER PETER'S PUPPET SHOW CONCERTO FOR HARPSICHORD

Robert Veyron-Lacroix, harpsichordist.
National Orchestra of Spain conducted
by Ataulfo Argenta. London LL1739.
Price \$4.98.

Here are two of Manuel de Falla's lesser-known works that deserve a wider public. "Master Peter's Puppet Show" is unusual in form, in scoring, and in presentation. There are three principal characters calling for a soprano, tenor, and baritone. The singing required of them is very different and off-beat... in his score, Falla gives specific instructions about how the roles are to be sung and

they are particularly directed not to "be too musical, or lyrical, or theatrical." If this sounds like the result would be awful, I assure you that it isn't. The usage is unique and you have to hear it for yourself, rather than trust to a description.

As with most Falla works, it is very colorfully scored with much use of percussion. This is apparent right from the opening bars with the roll of tympani and the rattle of snares. Throughout the score the sound is very clean with especially notable brass. Transients in all respects are quite free from distortion. Argenta's performance is absolutely masterful and true to the idiom. He realizes much more of the essential feeling of the work than do any of the other conductors in the competing versions.

The "Concerto for Harpsichord" is also most unusual. A prime reason is, of course, that the harpsichord is rarely used in modern works. Falla nods his head towards classical form and structure in this work, but all the rest is quite original and the harpsichord is used in ways that I'm sure the classicists never did! There is plenty of rhythmic drive in the score and the general flavor of the work still smacks of the Iberian school. Fine recording here, too, with the harpsichord miked quite close and with a subsequently "larger-than-life" sound, which is perfectly legitimate here. All-in-all, I found this a most rewarding musical experience.

PROKOFIEV

ROMEO AND JULIET BALLET (EXCERPTS)

New York Philharmonic conducted by
Dimitri Mitropoulos. Columbia ML5267.
Price \$3.98.

If ever a piece of ballet music was recorded in all conceivable formats to satisfy almost any taste, it is Prokofiev's "Romeo and Juliet." Depending on your liking of the work and how much you want to hear of it, it can be found on LP as a complete ballet or in the form of single, double, or triple suites. What's more, there are even multiple recordings of each of the forms. Mitropoulos draws on the first two suites for his material, selecting nine scenes which he has arranged more to the letter of the dramatic action of Shakespeare and less to the musical ideas of Prokofiev. Far from being odd sounding, these juxtapositions blend together quite logically and are certainly enjoyable to hear.

Mitropoulos' reading here brings out the colorful scoring and brilliantly shows off the orchestral palette. His pace is a bit faster than most and although his handling of the slower sections is most evocative, he can't

The opinions expressed in this column are those of the reviewer and do not necessarily reflect the views or opinions of the editors or the publishers of this magazine.

quite match the dramatic power and warm expressive beauty of the Stokowski version. Soundwise this is one of the best *Columbias* in some time. The recording is moderately close-up and favored with fine spacious acoustic balance, making for crisp orchestral detail with a fine sense of "liveness." Strings throughout were very bright but avoided any stridency, winds were smoothly balanced against rather weighty and imperious brass, percussion was sharp and accurate but would have been better with more impact. Dynamics were fairly wide and, all-in-all, little distortion was in evidence. This is probably the best recorded of the "shorter" suite versions of the ballet.

DEBUSSY **THREE NOCTURNES** **LA MER**

Concertgebouw Orchestra of Amsterdam conducted by Eduard Van Beinum. Epic LC3464. Price \$3.98.

What can one say about the umpteenth performance on disc of these well-worn works? Has this version something which makes it more desirable than all the rest? Well, without laboring the point, we can say that this is a good, expressive job of conducting, which flaunts no mannerisms and hews to the line on tempi. It is better than most available versions, not as good as the Paray and Toscanini readings.

One big point that may weigh heavily with some is that the orchestra is absolutely superb, a really virtuoso group that certainly is as good or better than any in Europe. The strings and woodwinds here are really luscious. Soundwise this is well and cleanly recorded, with fairly wide dynamics and reasonably spacious acoustics. In sum, a pleasant disc, representative of the works involved, but not of such overpowering excellence as to usurp one's affection for several other versions.

JOHN SEBASTIAN PLAYS BACH John Sebastian, harmonica; Paul Ulanowsky, pianist. Columbia ML5264. Price \$3.98.

Musical purists can stop right here, the very thought of a Bach sonata for piano and flute being transcribed for harmonica is enough to make them turn green. For others of a more inquiring nature, they will find that Mr. Sebastian is indeed a virtuoso of the harmonica and his transcriptions are all done in the very best of taste. I can't say that I personally care for the odd sound of the harmonica in what is ordinarily the flute part, but I must admit that Sebastian plays with real musicianship and after a while the sound sort of grows on you.

Ulanowsky furnishes particularly perceptive accompaniment to Sebastian and the whole has been very cleanly recorded, quite close-up, affording a proper and intimate sound with plenty of presence. Offbeat to be sure, but for anyone afflicted by musical ennui, perhaps it's just the ticket.

COPLAND **RODEO (FOUR DANCE EPISODES)** **EL SALON MEXICO** **DANZON CUBANO** Minneapolis Symphony Orchestra conducted by Antal Dorati. Mercury MG50172. Price \$4.98.

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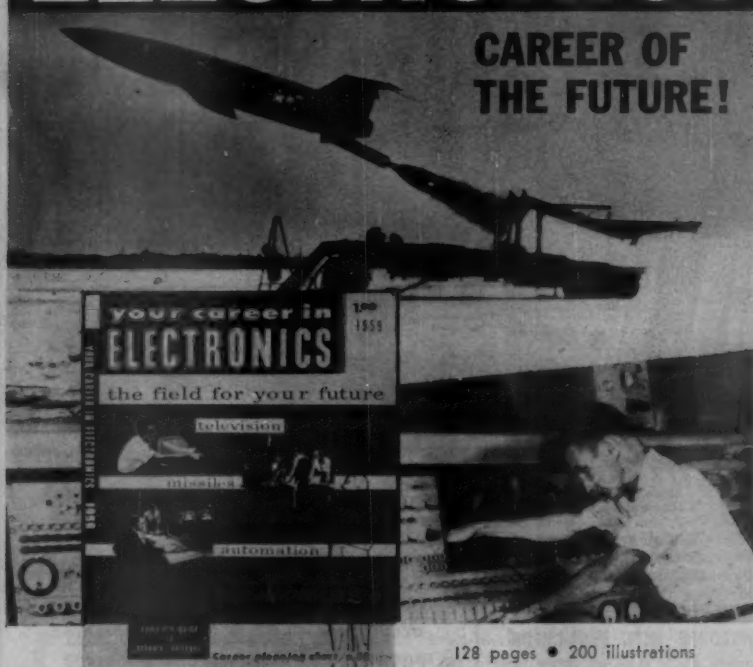
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is a rare individual who can resist its blandishments. The recording is of course that well-known and seemingly impossible blend of spotlighted ultra-sharp orchestral detail with rounded spacious acoustics which justly earns *Mercury's* soubriquet, "Living Presence." In every aspect of orchestral writing and color, this is recorded to bright-faceted perfection. The strings are smooth and edgeless and yet can zing and zip incisively when the score demands. The brass is awesome in its huge brazen liveness and weight, the woodwind so beloved by Copland are a pristine pure-toned delight. The percussion is simply staggering. The tympani and especially the bass drum in "El Salon Mexico," are among the biggest and loudest ever recorded. I guarantee you that through a big speaker driven by plenty of watts at a good room-filling level, the impact of that drum is almost frightening! And it's all nice and clean too, not lost in a sea of mud. I don't know whether it's the combination of music and hall and recording technique, but this is the best *Mercury* recording in a long time and I urge any who are interested in exciting sound and music not to miss hearing this outstanding disc.

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The ubiquitous Weavers are here again, as ingratiating as ever in a program of folk tunes of very wide origin and musical content. This is a group that most people either like with a vehement passion or detest with equal gusto. I freely admit I have never been much "taken" with the folk idiom, but this is one bunch that gets my vote for their sincerity and charm and downright solid musicianship. *Vanguard*, as usual, furnishes the group with bright, clean, well-balanced recording.

GEMINIANI

CONCERTI GROSSI (OPUS 7)

I Musici. Epic LC3467. Price \$3.98.

This is another in *Epic's* series of "Monumenta Italicae Musicae" and is, in every respect, equal to the fine quality of its predecessors. Admittedly, this is not music with a universal appeal, but to those who appreciate the similar writings of Corelli and Vivaldi, this will furnish much enjoyment. The *I Musici* is, as always, a splendid ensemble which plays with such dedicated musicianship as is rarely found these days. Under their expert urgings, these five concerti grossi are vibrantly fresh in melodic invention and revealing of rich harmonic structure.

This recording is quite high level and the over-all musical effect rather on the "big" side . . . perhaps a shade too much for a chamber-type work. The recording is close-up with just enough acoustic liveness to give depth and roundness to the sound. String sound is for the most part quite smooth and really quite opulent. For my taste I thought there was a trifle too much resonance in the bass line and sharper definition here would have been quite beneficial.

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Paolo Longinotti, trumpet; Andre Papi, flute; Edmond Leloir, horn; with L'Orchestre de la Suisse Romande conducted by Ernest Ansermet. London LL3020. Price \$4.98.

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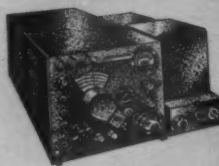
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Here, however, he is in good form furnishing bright sympathetic accompaniments, somewhat briskly paced for the soloists. The Haydn piece has always been one of the supreme tests of trumpet virtuosity which Longinotti impresses upon us.

The flutist does very well in his piece and as a whole the Mozart is the best conducted of the three works on this disc. The horn player is proficient and fluent, but I fail to detect much warmth or expression in his effort. Soundwise this is exceptional for the brilliant exposition of the trumpet and the smooth clarity of the flute, all neatly balanced with the orchestra. Wide dynamics and very quiet surfaces are plus virtues of an enjoyable disc.

DEBUSSY

RAVEL

PIANO MUSIC

Friedrich Gulda, pianist. London LL-1785. Price \$4.98.

Friedrich Gulda continues to buck the almighty competition of Gieseking and Casadeus in his review of the Debussy and Ravel piano literature. More often than not he is quite successful and in this instance more so. With Debussy he tackles "Reflections on the Water" and "Pour le Piano" among others and outside of a slight percussive hardness to his tone, he leaves little to be desired in terms of expressive dynamics and phrasing.

With Ravel he essays the "Sonatine" and "Valses Nobles et Sentimentales." In the "Valses" he reveals an exquisite fluency and grace coupled with considerable warmth and, with his slightly elevated tempi, the work is a complete delight. The artist is greatly aided by the sharp, pristine cleanliness of the piano, recorded fairly close-up for a fine sense of intimacy with just a hair of reverb to lend presence.

25-Watt Amplifier (Continued from page 65)

to a standard procedure. The results obtained from this power amplifier were extremely gratifying in that it was proved without a doubt that the quality is of the best and certainly worthy of being called a hi-fi component. The results obtained were as follows:

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Frequency Response: 8 to 45,000 cps, ± 1 db at the 2-watt output level. For maximum rated power output, frequency performance is 13 to 32,000 cps, ± 1 db.

IM Distortion (60 and 6000 cps: 4 to 1 ratio): with equivalent sine-wave output of 2 watts, the IM distortion is .085%. At the maximum rated output of 25 watts, the IM distortion is .285%. Since our standard calls for a maximum of 1% IM distortion as permissible, it is obvious that the .285% figure turned out extremely well. Actually the power amplifier will put out as much as 35.3 watts before it reaches the 1% figure.

Harmonic Distortion: at 1000 cps, 2-watt output, the harmonic distortion is .07%. At the 25-watt level, the harmonic distortion is .04%. At 20 cps the harmonic distortion is .1% at 2 watts and at 25.5 watts we obtained our acceptable distortion figure of 2%. At the high-frequency end (20,000 cps) the harmonic distortion figure is .14% at 2 watts output and 2% at 20 watts. The latter figure is somewhat low but the standard we have set is an extremely difficult one to meet. We have not as yet found any amplifier which would meet the 2% distortion figure at full rated output. We probably could lower our requirements and check all power amplifiers at 15,000 cps instead of 20 kc. but since all units are tested under similar conditions we would prefer to leave our standards as they are.

We found that the power amplifier is extremely stable irrespective of loud-speaker load or with any reasonable length of leads for remote speaker operation. Actually, we found no signs of instability when speaker terminals were left unloaded or even when a .1 µfd. capacitor was used in lieu of a speaker.

The damping factor was checked for an 8-ohm speaker load and we found that it followed closely the calibration on the dial. Our actual figures from minimum to maximum were .705 to 20.

There is one specific characteristic that warrants special mention and that is the sensitivity of .4 volt for maximum power output. This is a moderately low input in that most power amplifiers run between .5 volt and 1.5 volts. This is certainly not detrimental and, in some cases, the added sensitivity could be used to advantage. The manufacturer actually rates this sensitivity figure at .47 volt so that we can see that this figure is somewhat conservative.

Under-chassis view shows position of various components and printed circuit board.



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0A2	5AX4GT	6BC5	6L7	7J7	19
0B2	5AZ4	6BC7	6N7	7N7	19AU4GT
0B2	5B1K	6BD5	6Q7	7Q7	19B6GT
1A5GT	5BR9	6BD6	6S4	7Y4	19T8
1A7GT	5C08	6BE6	6S4GT	7Z4	24A
1B3GT	5C16	6BF5	6S7V	12A8	25A5V
1C5GT	5T6	6BF6	6S7	12A8B	25AX4
1H5GT	5U4G	6BG6	6S7F	12A8C	25BQ6
1L4	5U4GA	6BH6	6S7	12A8D	25D6
1L4	5U4GB	6B16	6S7	12A8E	25L6GT
1L6	5U6	6BK7	6S7	12A8F	25W4GT
1L6	5V4G	6B17GT	6S7	12A8G	25Z6
1N8GT	5V4GT	6B18	6S7	12A8H	26
1Q8GT	5X6	6B19	6S7	12A8I	35A5
1R5	5Y2GT	6B20	6S7	12A8J	35B5
1S5	5Y2GT	6B21	6S7	12A8K	35C5
1T4	5Y2GT	6B22	6S7	12A8L	35D5
1T4	5Y2GT	6B23	6S7	12A8M	35E5
1U4	5Y2GT	6B24	6S7	12A8N	35F5
1V2	5Y2GT	6B25	6S7	12A8O	35G5
1X2	5Y2GT	6B26	6S7	12A8P	35H5
2A3	5Y2GT	6B27	6S7	12A8Q	35I5
2A7	5Y2GT	6B28	6S7	12A8R	35J5
2A7	5Y2GT	6B29	6S7	12A8S	35K5
2A7	5Y2GT	6B30	6S7	12A8T	35L5
2A7	5Y2GT	6B31	6S7	12A8U	35M5
2A7	5Y2GT	6B32	6S7	12A8V	35N5
2A7	5Y2GT	6B33	6S7	12A8W	35O5
2A7	5Y2GT	6B34	6S7	12A8X	35P5
2A7	5Y2GT	6B35	6S7	12A8Y	35Q5
2A7	5Y2GT	6B36	6S7	12A8Z	35R5
2A7	5Y2GT	6B37	6S7	12A8A	35S5
2A7	5Y2GT	6B38	6S7	12A8B	35T5
2A7	5Y2GT	6B39	6S7	12A8C	35U5
2A7	5Y2GT	6B40	6S7	12A8D	35V5
2A7	5Y2GT	6B41	6S7	12A8E	35W5
2A7	5Y2GT	6B42	6S7	12A8F	35X5
2A7	5Y2GT	6B43	6S7	12A8G	35Y5
2A7	5Y2GT	6B44	6S7	12A8H	35Z5
2A7	5Y2GT	6B45	6S7	12A8I	36
2A7	5Y2GT	6B46	6S7	12A8J	37
2A7	5Y2GT	6B47	6S7	12A8K	38/44
2A7	5Y2GT	6B48	6S7	12A8L	43
2A7	5Y2GT	6B49	6S7	12A8M	45
2A7	5Y2GT	6B50	6S7	12A8N	48
2A7	5Y2GT	6B51	6S7	12A8O	50A5
2A7	5Y2GT	6B52	6S7	12A8P	50B5
2A7	5Y2GT	6B53	6S7	12A8Q	50C5
2A7	5Y2GT	6B54	6S7	12A8R	50D5
2A7	5Y2GT	6B55	6S7	12A8S	50E5
2A7	5Y2GT	6B56	6S7	12A8T	50F5
2A7	5Y2GT	6B57	6S7	12A8U	50G5
2A7	5Y2GT	6B58	6S7	12A8V	50H5
2A7	5Y2GT	6B59	6S7	12A8W	50I5
2A7	5Y2GT	6B60	6S7	12A8X	50J5
2A7	5Y2GT	6B61	6S7	12A8Y	50K5
2A7	5Y2GT	6B62	6S7	12A8Z	50L5
2A7	5Y2GT	6B63	6S7	12A8A	50M5
2A7	5Y2GT	6B64	6S7	12A8B	50N5
2A7	5Y2GT	6B65	6S7	12A8C	50O5
2A7	5Y2GT	6B66	6S7	12A8D	50P5
2A7	5Y2GT	6B67	6S7	12A8E	50Q5
2A7	5Y2GT	6B68	6S7	12A8F	50R5
2A7	5Y2GT	6B69	6S7	12A8G	50S5
2A7	5Y2GT	6B70	6S7	12A8H	50T5
2A7	5Y2GT	6B71	6S7	12A8I	50U5
2A7	5Y2GT	6B72	6S7	12A8J	50V5
2A7	5Y2GT	6B73	6S7	12A8K	50W5
2A7	5Y2GT	6B74	6S7	12A8L	50X5
2A7	5Y2GT	6B75	6S7	12A8M	50Y5
2A7	5Y2GT	6B76	6S7	12A8N	50Z5
2A7	5Y2GT	6B77	6S7	12A8O	51A5
2A7	5Y2GT	6B78	6S7	12A8P	51B5
2A7	5Y2GT	6B79	6S7	12A8Q	51C5
2A7	5Y2GT	6B80	6S7	12A8R	51D5
2A7	5Y2GT	6B81	6S7	12A8S	51E5
2A7	5Y2GT	6B82	6S7	12A8T	51F5
2A7	5Y2GT	6B83	6S7	12A8U	51G5
2A7	5Y2GT	6B84	6S7	12A8V	51H5
2A7	5Y2GT	6B85	6S7	12A8W	51I5
2A7	5Y2GT	6B86	6S7	12A8X	51J5
2A7	5Y2GT	6B87	6S7	12A8Y	51K5
2A7	5Y2GT	6B88	6S7	12A8Z	51L5
2A7	5Y2GT	6B89	6S7	12A8A	51M5
2A7	5Y2GT	6B90	6S7	12A8B	51N5
2A7	5Y2GT	6B91	6S7	12A8C	51O5
2A7	5Y2GT	6B92	6S7	12A8D	51P5
2A7	5Y2GT	6B93	6S7	12A8E	51Q5
2A7	5Y2GT	6B94	6S7	12A8F	51R5
2A7	5Y2GT	6B95	6S7	12A8G	51S5
2A7	5Y2GT	6B96	6S7	12A8H	51T5
2A7	5Y2GT	6B97	6S7	12A8I	51U5
2A7	5Y2GT	6B98	6S7	12A8J	51V5
2A7	5Y2GT	6B99	6S7	12A8K	51W5
2A7	5Y2GT	6B100	6S7	12A8L	51X5
2A7	5Y2GT	6B101	6S7	12A8M	51Y5
2A7	5Y2GT	6B102	6S7	12A8N	51Z5
2A7	5Y2GT	6B103	6S7	12A8O	52A5
2A7	5Y2GT	6B104	6S7	12A8P	52B5
2A7	5Y2GT	6B105	6S7	12A8Q	52C5
2A7	5Y2GT	6B106	6S7	12A8R	52D5
2A7	5Y2GT	6B107	6S7	12A8S	52E5
2A7	5Y2GT	6B108	6S7	12A8T	52F5
2A7	5Y2GT	6B109	6S7	12A8U	52G5
2A7	5Y2GT	6B110	6S7	12A8V	52H5
2A7	5Y2GT	6B111	6S7	12A8W	52I5
2A7	5Y2GT	6B112	6S7	12A8X	52J5
2A7	5Y2GT	6B113	6S7	12A8Y	52K5
2A7	5Y2GT	6B114	6S7	12A8Z	52L5
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2A7	5Y2GT	6B116	6S7	12A8B	52N5
2A7	5Y2GT	6B117	6S7	12A8C	52O5
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2A7	5Y2GT	6B119	6S7	12A8E	52Q5
2A7	5Y2GT	6B120	6S7	12A8F	52R5
2A7	5Y2GT	6B121	6S7	12A8G	52S5
2A7	5Y2GT	6B122	6S7	12A8H	52T5
2A7	5Y2GT	6B123	6S7	12A8I	52U5
2A7	5Y2GT	6B124	6S7	12A8J	52V5
2A7	5Y2GT	6B125	6S7	12A8K	52W5
2A7	5Y2GT	6B126	6S7	12A8L	52X5
2A7	5Y2GT	6B127	6S7	12A8M	52Y5
2A7	5Y2GT	6B128	6S7	12A8N	52Z5
2A7	5Y2GT	6B129	6S7	12A8O	53A5
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2A7	5Y2GT	6B136	6S7	12A8V	53H5
2A7	5Y2GT	6B137	6S7	12A8W	53I5
2A7	5Y2GT	6B138	6S7	12A8X	53J5
2A7	5Y2GT	6B139	6S7	12A8Y	53K5
2A7	5Y2GT	6B140	6S7	12A8Z	53L5
2A7	5Y2GT	6B141	6S7	12A8A	53M5
2A7	5Y2GT	6B142	6S7	12A8B	53N5
2A7	5Y2GT	6B143	6S7	12A8C	53O5
2A7	5Y2GT	6B144	6S7	12A8D	53P5
2A7	5Y2GT	6B145	6S7	12A8E	53Q5
2A7	5Y2GT	6B146	6S7	12A8F	53R5
2A7	5Y2GT	6B147	6S7	12A8G	53S5
2A7	5Y2GT	6B148	6S7	12A8H	53T5
2A7	5Y2GT	6B149	6S7	12A8I	53U5
2A7	5Y2GT	6B150	6S7	12A8J	53V5
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2A7	5Y2GT	6B155	6S7	12A8O	54A5
2A7	5Y2GT	6B156	6S7	12A8P	54B5
2A7	5Y2GT	6B157	6S7	12A8Q	54C5
2A7	5Y2GT	6B158	6S7	12A8R	54D5
2A7	5Y2GT	6B159	6S7	12A8S	54E5
2A7	5Y2GT	6B160	6S7	12A8T	54F5
2A7	5Y2GT	6B161	6S7	12A8U	54G5
2A7	5Y2GT	6B162	6S7	12A8V	54H5
2A7	5Y2GT	6B163	6S7	12A8W	54I5
2A7	5Y2GT	6B164	6S7	12A8X	54J5
2A7	5Y2GT	6B165	6S7	12A8Y	54K5
2A7	5Y2GT	6B166	6S7	12A8Z	54L5
2A7	5Y2GT	6B167	6S7	12A8A	54M5
2A7	5Y2GT	6B168	6S7	12A8B	54N5
2A7	5Y2GT	6B169	6S7	12A8C	54O5
2A7	5Y2GT	6B170	6S7	12A8D	54P5
2A7	5Y2GT	6B171	6S7	12A8E	54Q5
2A7	5Y2GT	6B172	6S7	12A8F	54R5
2A7	5Y2GT	6B173	6S7	12A8G	54S5
2A7	5Y2GT	6B174	6S7	12A8H	54T5
2A7	5Y2GT	6B175	6S7	12A8I	54U5
2A7	5Y2GT	6B176	6S7	12A8J	54V5
2A7	5Y2GT	6B177	6S7	12A8K	54W5
2A7	5Y2GT	6B178	6S7	12A8L	54X5
2A7	5Y2GT	6B179	6S7	12A8M	54Y5
2A7	5Y2GT	6B180	6S7	12A8N	54Z5
2A7	5Y2GT	6B181	6S7	12A8O	55A5
2A7	5Y2GT	6B182	6S7	12A8P	55B5
2A7	5Y2GT	6B183	6S7	12A8Q	55C5
2A7	5Y2GT	6B184	6S7	12A8R	55D5
2A7	5Y2GT	6B185	6S7	12A8S	55E5
2A7	5Y2GT	6B186	6S7	12A8T	55F5
2A7	5Y2GT	6B187	6S7	12A8U	55G5
2A7	5Y2GT	6B188	6S7	12A8V	55H5
2A7	5Y2GT	6B189	6S7	12A8W	55I5
2A7	5Y2GT	6B190	6S7	12A8X	55J5
2A7	5Y2GT	6B191	6S7	12A8Y	55K5
2A7	5Y2GT	6B192	6S7	12A8Z	55L5
2A7	5Y2GT	6B193	6S7	12A8A	55M5
2A7	5Y2GT	6B194	6S7	12A8B	55N5
2A7	5Y2GT	6B195	6S7	12A8C	55O5
2A7	5Y2GT	6B196	6S7	12A8D	55P5
2A7	5Y2GT	6B197	6S7	12A8E	55Q5
2A7	5Y2GT	6B198	6S7	12A8F	55R5
2A7	5Y2GT	6B199	6S7	12A8G	55S5
2A7	5Y2GT	6B200	6S7	12A8H	55T5

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Service Industry

RADIO SERVICE

TV

News

THE INFLUENCE of service-association house organs in shaping and crystallizing the opinions of dealers on basic issues has been growing steadily. Through the interchange of their publications and editorial copy, house-organ editors are bringing to the attention of their readers the thoughts and opinions of dealers in many sections of the country. The result is a steady firming up of programs designed to put the activity on a more solid foundation.

The latest formal house organ to make its bow was launched recently by the newly formed Television Service Association of Delaware Valley. A monthly publication titled "TSA News," it is edited by Ray Fink with Charles Knoell, TSADV publicity chairman, as its associate editor. The official address of the new magazine is % Ray Fink, Editor "TSA News," 7819 Rugby Street, Philadelphia 50, Pa. Ray H. Cherrill, 6321 Frankford Ave., Philadelphia, Pa., is president of TSADV.

Another recent addition to the growing ranks of association publications is the "Service Dealers Bulletin" published by the members of the Radio & Television Service Dealers Association of Durham, N. C. The "Bulletin," which will be issued on a monthly basis, is edited by Garland E. Hoke with Norman Schultz as assistant editor.

The Durham association is noted for its sponsorship of an electronic technician training program under the plan available through state educational institutions with the cooperation of the apprenticeship training section of the U. S. Department of Labor. Subsequently an advanced black-and-white TV service school was added to the original apprenticeship program. Diplomas were recently issued to ten Durham dealers and technicians who completed the advanced course in black-and-white TV servicing.

Charles S. McBroom of Mac's TV Service, is president of the Durham association. The business address of the organization is P. O. Box 222, East Durham, N. C.

An outstanding "veteran" in the way of association house organs is the "ARTSD News," the official publication of the Associated Radio-Television Service Dealers of Columbus, Ohio. Now in its fifteenth year of consecutive monthly publication, the "News" carries local and national service items in a breezy, concise, informative style. It is edited and published by John P. Graham who is proud of his membership in the Radio's Old Timers Club, which signifies a minimum of twenty years active participation in the radio industry. The business address of the

"ARTSD News" is 2552 North High Street, Columbus, Ohio.

The Columbus association also claims to be the first business organization of service dealers. It was formed back in the radio days when service associations were primarily technical groups. ARTSD sponsors several types of social and business events that are held annually and which serve to maintain a high level of interest among members. Their regular, quarterly meetings with parts distributors, which have been carried out since the inception of the association, have created a spirit of distributor-dealer cooperation in the Columbus area that has been very beneficial to both groups.

"Veteran" Elected

In Philadelphia, another "old timer" in the ranks of service associations recently elected a 50-year service-industry veteran to serve as its president for the coming year. Richard Devaney, owner of the Radio Electric Service Co., was the unanimous choice of the members of the Philadelphia Radio Servicemen's Association to head their organization. Devaney, who is observing his fiftieth year in the electronics industry, has been active in PRSMA affairs for a number of years. He served previously as a member of the Board of Directors and as a vice-president of the organization.

Other officers elected by the PRSMA membership include William Poole, vice-president; Al Gribben, recording secretary; C. P. Elliott, corresponding secretary; and William Humes, treasurer.

In Savannah, Georgia, a group of service dealers recently formed the Savannah TV and Radio Dealers Association in a move to stabilize the service activity in that area. Information about this new association may be obtained from W. L. Parktee, president of the association, % Downey's Inc., 2503 Waters Ave., Savannah, Georgia.

NATESA Award

The National Alliance of Television and Electronic Service Associations has presented an award to CBS-Hytron for "outstanding service in creating better customer relations." The award was presented by Frank Moch, executive director of NATESA, to A. L. Chapman, CBS-Hytron president.

Starting an Association?

Dealers who are interested in forming either a service dealer or technicians' association may obtain a complete package of organizational material from the National Alliance of

48¢ ea. for any tube

\$45.00 Per Hundred

STANDARD LINE

ELECTRIC COMPANY

FREE TUBE BRIGHTENER ON ORDERS OF \$10.00 OR MORE

FREE POSTAGE IN U.S.A. & TERRITORIES

ANNOUNCING OUR NEW PRICE SCHEDULE

Effective July 25, 1958 all tubes (Radio & Television receiving) will be sold and shipped at the fantastic price of only 48¢ ea. or \$45.00 per hundred. Any "on hand" orders at that time will receive credit for future purchases.

THE TUBES ADVERTISED HEREIN ARE NOT NECESSARILY NEW TUBES BUT MAY BE ELECTRICALLY PERFECT FACTORY SECONDS OR USED TUBES AND ARE SO MARKED.

All TV & Radio Tubes are tested by our supplier under actual conditions in Radio & TV chassis or in Hickock Tube Testers Model 533A.

And, of course, the famous Standard Line guarantee remains in effect: All tubes guaranteed to be replaced free if they fail to function efficiently within one year's time. (defective tubes must be returned intact, postage paid. Refunds will be cheerfully made within five (5) days if not completely satisfied.)

6B2	3A15	3V4GT	6B4	454	777	12Q7	31L7GT
6Z4	3A16	5W4GT	6B5	459GT	778	12SA7	35/31
1A5GT	3A16	5X40	6B6	45A7	767	12S7	35A5
1A7GT	3B4A	5X8	6B6	45B7Y	7H7	12SJ7	35B5
1B3GT	3B5	3Y3GT	6B8	45C7	7J7	12SK7	35C5
1C5GT	3B6	3Y40	6B9	45F5	7K7	12SH7GT	35L6GT
1C6	3B6	3Z3	6B9	45F7	7L7	12SQ7	35W4
1C7	3B8	3Z4	6B9	45H7	7M7	12SR7	35Y4
1H40	3B6	6A8	6B1GT	65J7	7Q7	12V6GT	35Z4GT
1H5GT	3B6	6A8	6B6	65K7	7R7	12W6GT	35Z5GT
116	3C2	6A7	6B6GT	65L7GT	7S7	12X4	#37
11A4	3C8	6A7	6B7	65M7GT	7T7	12Z3	#39/44
11A4	3C7	6A5	6B8	65Q7	7W7	14A7	#41
11B4	3C5	6A7	6B8	65R7	7X7	14A7	#42
11C5	3D16	6A1GT	6B9	65S7	7Y7	14B6	#43
11C6	3D4	6A6	6B2	678	7Y4	14B7	#43
11H4	3Q5GT	6A5	6B2	6D4GT	7Z4	14B8	#47
11H5	354	6A5	6C4	6B5	8A7B	14B7	56A5
1H5GT	3V4	6A15	6C5	6B8	12A8	14B7	56B5
1P5GT	4B8	6A1GT	6C5	4V3	12A8	14Q7	56C5
1Q5GT	4B7A	6A8	6C6	4V6GT	12A8	14S7	56C6
1B5	4B8	6A8	6C6GT	4W4GT	12A7	17A4GT	56L6GT
155	4B8	6A5	6C6	4W4GT	12A7	17D6	56Y4
174	4B7	6A6	6C7	6X4	12A6	19A4	56Y7
175GT	4C8	6A7GT	6C8	6X5GT	12A7	19B6GT	#57
1U4	5A8	6A5	6C8	6X8	12A6	19C8	#58
1U5	5A8	6A5	6C16	6Y6GT	12A7	19J6	#80
1V	5A5	6A5	6C6	7A4	12AX4GT	19T8	#81
1V2	5A5	6A7	6C7	7A5	12AX7	19X8	117LGT
1X2	5A7	6A4GT	6C7	7A6	12A7	25A5	117MGT
2A3	5A7	6A5GT	6C6	7A7	12B4	25AV5GT	117P7GT
2A5	5A7	6A6	6D6	7A8	12B4	25AX4GT	117Z3
2A7	5A7	6A8	6D6	7B4	12B5	25B5	117Z4GT
2A7A	5B7	6A5GT	6D6	7B5	12B6	25B6	117Z6GT
2B7	5B8	6A6	6E5	7B6	12B7	25C6GT	807
2B4	5B7	6A6	6H6	7B7	12B8	25C6	9002
2D1	5B7	6A4GT	6J4	7B8	12B6	25L6GT	9003
2B5	5C6	6A5GT	6J5	7C4	12B7	25W4GT	9006
2K3A	5J6	6A28	6J6	7C5	12C5	25Z3	
3A2	5B8	6A6	6K4GT	7C6	12C6	25Z6	
3A3	5B8	6B5	6K7	7C7	12D6	#27	
3A4	5H40	6B8	6L4	7E4	12J5	#30	
3A5	5V40	6B6	6L7	7E7	12L6GT	#31	

ALL RECEIVING TUBES SENT POSTAGE PAID.
Please send 25¢ handling for orders under \$5.00. Send 25% deposit on C.O.D. orders and please send approximate postage on Canadian and foreign orders.

Above is only a partial list — order any type at the same price or send for free tube list and order blank. We have over 5,000 tube types on hand or at easy access, including special purpose, industrial and transmitting tubes which are slightly higher.

ALL TUBES GUARANTEED ONE FULL YEAR...

NOTE: When ordering receiving tubes be sure to enclose 48¢ for each tube or \$45.00 per hundred.

Thousands of TRADE-IN TVs

Please Specify Console or Table Model When Ordering
Reconditioned By Factory Trained Technicians! Guaranteed To Be in Working Condition When You Receive Them!

10"	\$25.00	19"	\$56.00
12"	\$30.00	20"	\$63.00
14"	\$35.00	21"	\$70.00
16"	\$42.00	24" (when available)	\$95.00
17"	\$49.00	27" (when available)	\$129.00

Get yourself a second set or buy some for re-sale!

All TVs sent motor freight or Railway Express F.O.B. our warehouse. Sorry, no A.P.O. shipments.

FREE INDOOR ANTENNA with each TV Purchase

below is our new price schedule of pix tubes. These famous make tubes contain all new parts with the exception of the glass bulb which does not wear out.

Any 10" Tube	\$ 9.95	Any 16" Tube	15.95
Any 12" Tube	10.95	Any 17" Tube	18.29
Any 14" Tube	13.95	Any 19" Tube	20.29
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ANY QUANTITY

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☐ I'm a Service Technician: ☐ full time; ☐ part time

My Distributor is:

Shop Name:

Attn:

Address:

City: Zone: State:

Television and Electronic Service Associations. Included in this package is information about how to organize a formal association, suggested articles of incorporation, bylaws, formation of committees, etc. This may be obtained by writing to NATESA headquarters, 5908 South Troy Street, Chicago 29, Ill.

Service Story Folder

A new pocket-size folder, "TV Service Safety Hints," is being made available by P. R. Mallory & Co. to be used by service technicians and dealers in promoting a better understanding of their role with customers. A series of cartoons dramatize the dangers of amateur "doctoring" of TV ailments in a light style. The set owner is told, "Don't do it yourself—call on us!" There is space for imprinting the dealer's name. The folders are available in quantity to individual dealers and associations from Mallory distributors at \$1.00 per 100, or by writing to Distributor Division, P. R. Mallory & Co., Inc., Indianapolis 6, Indiana.

Two-Way Mobile News

Service dealers looking for diversification and alert to the sturdy growth of two-way mobile radio equipment can get started in this field by making contact with those manufacturers of such equipment who are interested in working through independents rather than their own organizations. Putting in a bid for dealer interest, Kaar Engineering Corp. is marketing a line of "packaged" merchandise in this field to minimize the problems of system engineering. Interested dealers should address inquiries to Frank A. Genocchio, Kaar Engineering Corp., 2995 Middlefield Road, Palo Alto, Calif.

Licensing News

In Waterloo, Iowa, the City Council was recently urged by local service dealers to take the lead in establishing regulations and a licensing code for television technicians.

Ulwin W. Davis, president of the Waterloo Radio-Television Service Dealers Association, presented the association's petition for a licensing code to the City Council. Mr. Davis said that, while Waterloo residents have been fortunate in not being preyed upon by unscrupulous technicians, he felt there is a need now for a protective measure to guard against an incursion of incompetents.

In Des Moines, a proposed licensing measure was indefinitely tabled by a majority vote of the City Council of that city. In reporting on this development, which was aggressively opposed by the Association of Independent Servicemen of Iowa, Frank Arnold, editor of the "AITS Scope," said:

"The burden of government regulation of our business is already heavy enough. That there remains much to be accomplished by the service industry is evident, but licensing is not the cure-all that it has been reported to be.

"The only way the serviceman of this city can increase his stature in the pub-

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STORAGE BATTERIES

Long life, indefinite storage, low internal resistance, hi-discharge and recharge rates.



Now Surplus Government cells as used in guided missiles, yours for a fraction of the original cost. Each cell produces approx. 1.2-1.5 volts at discharge rates up to 40 or more Amps. Order postpaid these alkaline sintered plate cells to make batteries to your specs, or order complete batteries as listed.

ALL POSTPAID		
1.5V	1 cell	\$ 1.95
6 V	5 cell	7.95
12 V	10 cell	14.95
24 V	20 cell	24.95

Cell size 6" H x 2" W x 1 1/2" T. WL 7 oz. ea.

Uses non-corrosive potassium hydroxide electrolyte—negligible loss during lifetime service. ORDER TODAY!

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RADIO & TV NEWS

lic eye is by the service he performs. It is the responsibility of the serviceman to maintain a high standard in the service he renders. That the standards have been and are being maintained is an established fact. Not one complaint has been received by our grievance committee since our members' names were filed with the Better Business Bureau. I can say 'well done' and I am proud of that record."

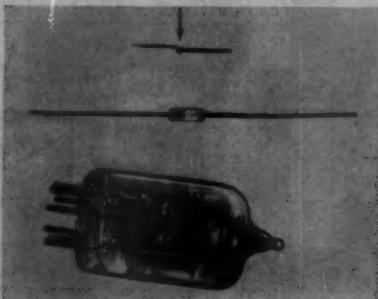
In Toledo, Ohio, a committee appointed by the city administration to look for new sources of revenue came up with the bright idea of taxing TV services. Their recommendation was to levy an annual tax of \$30.00 on Repairmasters (service dealers) and \$3.00 per year for servicemen.

On the heels of its successful convention, the Radio & Television Technicians Guild of Florida, Inc., inaugurated an expanded program to enlarge its membership and to intensify its efforts to develop better customer relations. As its first step, the association engaged George S. Miller, a professional trade association executive and public relations counsel, to serve as its executive director. In this post, he succeeds Shan Desjardins, who handled this activity for two years and requested help in administering the affairs of the Guild. The mailing address of the RTTG of Florida will continue to be 119 N.W. 12th Ave., Miami 36, Fla.

Advanced Training

Evening instruction for upgrading the practicing TV technician will be given for the sixth straight year at the endowed, non-profit New York Trade School, 310 E. 67th St., New York City. Paul B. Zbar, head of the Electronics Dept., urges early registration for this industry-sponsored course, as class size will be limited. The course begins on the evening of September 18, 1958, and will run for 16 weeks. Entrants must have had at least 3 years full-time experience as TV technicians or 1 year experience in addition to a basic, approved TV course.

Successful development of the world's smallest hermetically sealed diode, tinier than a pinhead was announced by Pacific Semiconductors, Inc. A new glassification process makes the new electronic "tiny tin" possible by eliminating the conventional diode package. Photo shows the new diode (top) contrasted with conventionally packaged glass diode (center) and subminiature 6AL5 duo-diode tube.



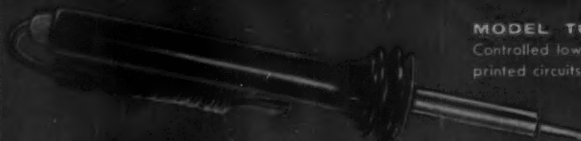
September, 1958

A must
for TV and
radio
service
technicians



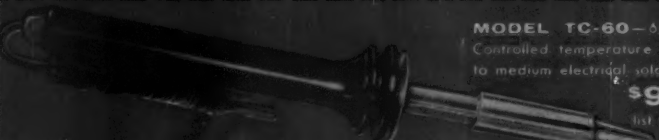
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Controlled lower temperature for
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to medium electrical soldering.

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dium to heavy electrical soldering.

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Here's another "first" from Weller, long time leader in the soldering field. New soldering irons with built-in MAGNASTAT temperature control for more reliable soldered connections. Never any overheating. Proper soldering temperature automatically remains constant. Plus these other exclusive features:

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Sensing device is in the tip
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sheath of stainless steel.
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efficiency and screw
on simply and securely.

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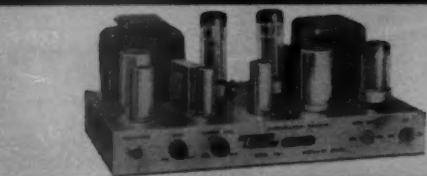
EICO



New

90-WATT CW TRANSMITTER #720
KIT \$79.95 WIRED \$119.95

Conservative, highly efficient design plus stability, safety, and excellent parts quality. Covers 80 thru 40, 20, 15, 11, 10 meters (popular operating bands) with one knob band-switching. 6146 final amplifier for full "clean" 90W input, protected by clamper tube circuit. 6CL6 Colpitts oscillator, 6AQ5 clamper, 6AQ5 buffer-multiplier, GZ34 rectifier. "Novice limit" calibration on meter keeps novice inside the FCC-required 75W limit. No shock hazard at key. Wide range, hi-efficiency pi-network matches antennas 50 to 1000 ohms, minimizes harmonics. EXT plate modulation terminals for AM phone modulation with 65W input. Excellent as basic exciter to drive a power amplifier stage to maximum allowable input of 1KW. Very effective TVI suppression. Ingenious new "low silhouette" design for complete shielding and "living room" attractiveness. Finest quality, conservatively rated parts, copper-plated chassis, ceramic switch insulation. 5" H, 15" W, 9 1/2" D.



NEW UNIVERSAL MODULATOR-DRIVER #730
KIT \$49.95 WIRED \$79.95 Cover E-5 \$4.50

Superb, truly versatile modulator at low cost. Can deliver 50 watts of undistorted audio signal for phone operation, more than sufficient to modulate 100% the EICO #720 CW Transmitter or any xmitter whose RF amplifier has a plate input power of up to 100W. Multi-match output xmr matches most loads between 500-10,000 ohms. Unique over-modulation indicator permits easy monitoring, precludes need for plate meter. Low level speech clipping and filtering with peak speech frequency range circuitry. Low distortion feedback circuit, premium quality audio power pentodes, indirectly heated rectifier filament. Balance & bias adjust controls. Inputs for crystal or dynamic mikes, phone patch, etc. Excellent deluxe driver for high-power class B modulation. ECC83/12AX7 speech amplifier, 6AL5 speech clipper, 6AN8 amplifier driver, 2-EL34/5CA7 power output, EMB4 over-modulation indicator, GZ34 rectifier. Finest quality, conservatively rated parts, copper-plated chassis. 8" H, 14" W, 8" D.

NEW GRID DIP METER #710
KIT \$29.95 WIRED \$49.95 including complete set of coils for full band coverage.

Exceptionally versatile. Basically a VFO with micro-ammeter in grid; determines freq. of other osc. or tuned circuits; sens. control & phone jack facilitate "zero beat" listening. Excellent absorption wave meter. Ham uses: pre-tuning & neutralizing xmitters, power indication, locating parasitic osc., antenna adj., correcting TVI, de-bugging with xmitter power off, determining C.I.Q. Servicing uses: alignment of filters, IF's; as sig. or marker gen. Easy to hold & thumb-tune with 1 hand. Continuous 400 kc - 250 mc coverage in 7 ranges, pre-wound 0.5% accurate coils. 500 us meter movement. 6AF4(A) or 6T4 Colpitts osc. Xmr-operated sel. rect. 2 1/2" H, 2 1/4" W, 6 3/4" L. Satin deep-etched aluminum panel; grey wrinkle steel case.



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See EICO's Hi-Fi and Test Equipment ads on Pages 35 and 36.

Electronic Crossword

By JOHN J. GILL

THIS puzzle may prove to be a "fooler" as there are several unusual definitions and a number of obscure words which you will have to work around if your vocabulary of "exotic words" is rusty. Don't feel too discouraged if you don't get it the first time—the answer appears on page 166 if you want to peek!

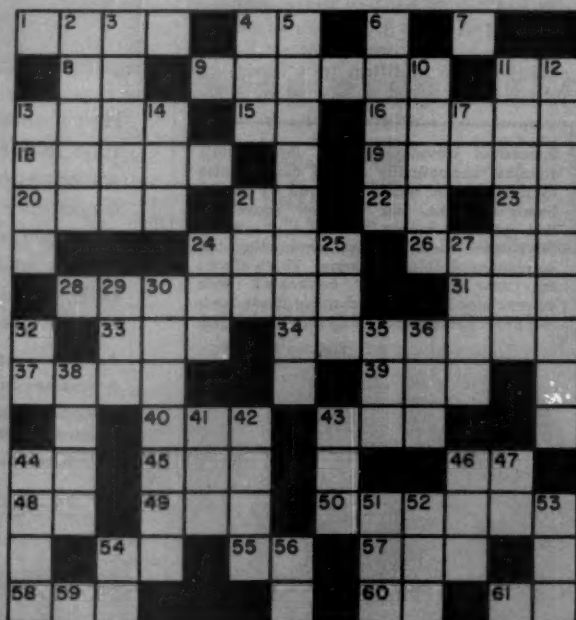
ACROSS

1. 1/746th of 1 hp.
4. Lower than r.f. (abbr.).
7. 1000 (abbr.).
8. French article.
9. Voltage on an electrolytic causes it to be —.
11. TV frequency band (abbr.).
13. Used in drills.
15. Pilot light (abbr.).
16. Maurice isn't here (slang).
18. Si, Jah, Oul.
19. Borer.
20. Chew.
21. Tube characteristic.
22. Spanish agreement.
23. Telemetering (abbr.).
24. Demeanor.
26. Oriental nurse.
28. Insects and radio sets have one.
31. Time gone by.
33. Unit of work.
34. TV band assignment.
37. Against.
39. Regret.
40. German electrician.
43. Deed.
44. 2π FL.
45. Two (comb. form).
46. Electronic test set.
48. 1050 (Roman style).
49. Electric driving force.
50. Tube book.
54. Estados Unidos (Eng. abbr.).
55. Gallic (abbr.).
57. As opposed to "min."
58. Voltage dropper (abbr.).

60. Amplifier output stage (abbr.).
61. 1/6.28fC.

DOWN

2. Twiddle the trimmers.
3. Four (comb. form).
4. Charged particle.
5. Cycles per unit of time.
6. Affords.
10. Andrea —.
11. E.M.F.
12. Resonator.
13. "Pokes" (coll.).
14. Mend.
17. Third note of scale.
21. Opposite of "max."
24. Million (comb. form).
25. Sloppy "no."
27. On a horse's neck.
29. Type of "work" in radio.
30. Three-element tubes.
32. Current measure (abbr.).
35. Leaping current.
36. Fastener.
38. Point of balanced frequencies.
41. Could be a bad capacitor.
42. A thin silk made in Caucasasia.
43. Motor winding (abbr.).
44. Transmitter (abbr.).
46. Light.
47. B flat in Tartini's system of solmization.
51. Unit of electric current.
52. Sleep.
53. Used in making varnish.
54. We.
56. It travels at the speed of light (abbr.).



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2 for only **\$12.00!**

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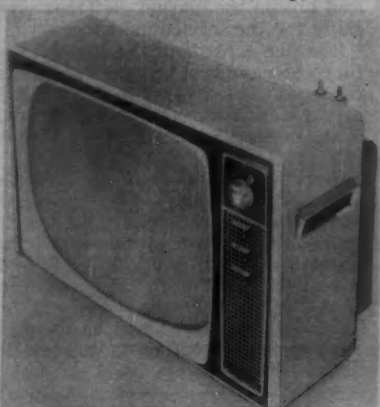
What's New in Radio

SHALLOW TV SETS

The Television Receiver Department of General Electric Company, Syracuse, N. Y. has unveiled its new "Designer Series," a line of TV receivers whose unique cabinet design gives the appearance of extreme slimmness.

The "Gramercy 17's" and the "Barclay 21's" comprise the two sizes in the series. The former uses the 110 degree aluminized picture tube with 155 square inches of picture area while the latter provides 262 square inches of viewing space.

The cabinets are formed of vinyl-covered aluminum in the 21-inch models and high-impact, color impregnated polystyrene in the 17-inch models. The cabinets follow as closely as possible the contours of the picture tube. In place of the conventional hard-board back and tube cap, the set



has a contoured steel panel back. This panel extends out from the cabinet to accommodate the picture tube but is not as wide nor as high as the cabinet itself.

The polystyrene cabinets are available in aqua, beige, or mahogany with oyster white tube masks. The cabinets for the 21-inch sets are aluminum covered in scuff and stain resistant vinyl in russet with leather finish or a linen finish, both with dove grey tube masks.

NEW TUBES FOR MOBILE

The Electron Tube Division of Radio Corporation of America, Harrison, N. J. has announced the availability of eight new industrial tubes for two-way mobile radio systems operating from 12-volt storage batteries.

The new tubes are especially designed for transceiver applications. To insure dependable performance when storage batteries are charging and discharging, the heaters of these tubes

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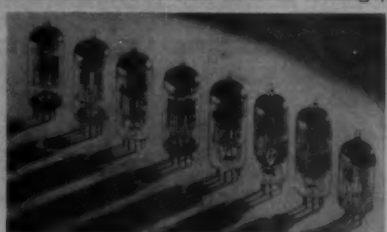
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are designed to withstand an intermittent heater-cycling test of 2000 cycles minimum at high heater voltage. Designed to operate over a heater voltage range of 12 to 15 volts, the tubes are subjected to rigid controls and tests for heater-cathode leakage,



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Included in the new series are the 7054 and 7056 sharp cut-off pentodes, 7055 twin diode, 7057 medium-mu twin-triode, 7058 high-mu twin-triode, 7059 and 7060 medium-mu triode-sharp cut-off pentodes, and 7061 beam power tube.

ALPHA TEST-LEAD LINE

Alpha Wire Corporation, 200 Varick St., New York 14, N. Y. has a new test-lead line on the market, designed especially for the service industry.

The line consists of the 12 most useful combinations of test prod and meter tip types. The lead wires are a full 50 inches long and are made of #18 gauge wire encased in heavy-duty, high-dielectric rubber. Voltage breakdown is better than 12,000 volts at 60 cycles.

A special display rack, measuring 38" x 27 1/4" x 12", holds ten each of the 12 different test-lead items and features each pair of test leads individually packed in an attractive, dirt-free, clear plastic tube.

The manufacturer will be happy to supply complete details on this new line upon written request.

SELF-SERVICE TUBE CHECKER

Century Electronics, 111 Roosevelt Ave., Mineola, N. Y. is now offering a

self-service tube checker which is suitable for the "do-it-yourself" departments of service shops or for bench mounting in the service lab.

The Model SS-1 "Fast - Check" will handle over 600 tube types with only two settings. It will check quality, shorts, and leakage, as well as gas content. The circuit is so designed that it will accept new tube types as they appear on the market.

A colorful display tops the cabinet with a tube chart installed directly below the ad panel. The 7 1/2-inch meter is designed to withstand rough handling and is fully protected against accidental burn-out. The tester operates on 117-

volt power lines and has a three-wire UL-approved line cord.

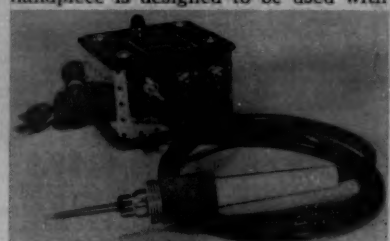
The company is offering this tester in both console and counter models. Write the manufacturer direct for free literature and further details.

MINIATURE SOLDERING TOOL

Wassco Electric Products Corp., 204 S. Larkin Ave., Joliet, Ill. is currently marketing a new low-cost dual-metal-tip soldering tool designed for continuous industrial production soldering.

Especially suited to soldering of miniature connectors and other precision operations, the handpiece provides two very slim metal alloy electrodes arranged at a 3-degree included angle. By adjusting electrodes in or out, the working gap at the tip is easily set from 1/16" up to 3/16" for best accommodation to the work at hand.

The tapered tips of the electrodes provide a pre-loaded spring tweezer function without finger fatigue. The handpiece is designed to be used with



the firm's new 105-A1 100-watt power unit but may also be used with the 105-B2 500-watt unit. The 105-A1 has three heat outputs; 15, 50, and 100 watts. The handpiece and power unit together are catalogued as Bench Set No. 10579.

WIRE DISPENSER KIT

Belden Manufacturing Company of Chicago has recently introduced a new hook-up wire dispenser kit which is designed to eliminate the problems of waste and inconvenience for the technician, hobbyist, and experimenter.

The kits are being offered in the 14 most popular assortments of vinyl, vinyl-nylon, textile, and Teflon insulated wires. The rack, which holds five square spools of wire, is given free of charge. The rack is so designed that it can be hung on the wall or stood on the bench.

Since the dispenser kits are individually packaged in colorful illustrated cartons, they can double as counter or rack displays.

BATTERY ELIMINATOR

Seco Manufacturing Company, 5015 Penn Avenue South, Minneapolis, Minn. has recently introduced its Model PS-2 battery eliminator which is specially designed for operating and servicing portable radios and low-power transistorized equipment.

The PS-2 supplies filtered d.c. in voltages from 0 to 15. The output supply is sufficient for checking transistor receivers of up to 22.5 volts. The unit can also be used to check batteries by substitution. The eliminator uses a

line bypass system to eliminate hum modulation. Internal impedance is less than 2 ohms. The voltage scale is



calibrated at 15 ma. while maximum output is 100 ma.

The instrument comes complete with plug-in jacks for an external voltmeter, 40-inch leads, and insulated clips. The case measures 4½" x 5" x 1½". For complete information and a descriptive data sheet, write the manufacturer direct.

WRL "SIDEBANDER"

WRL Electronics, 34th & Broadway, Council Bluffs, Iowa is now offering a complete bandswitching suppressed-carrier sideband rig, in kit or assembled form, as the DSB100.

The "Sidebander" offers continuous band coverage from 3 to 9 mc. and 12 to 30 mc. which includes all the popular MARS, CAP, and special emergency service frequencies. Designed for double-sideband, AM, or c.w., the unit may be used to convert present AM equipment to sideband



and can be used with standard crystals and regular v.f.o. There is a minimum of 35 db carrier suppression.

A three-stage r.f. section allows straight-through operation for maximum efficiency on all bands. An internal tone generator facilitates tuning. The pi-net output is 52 to 1000 ohms. Speech clipping and filtering assures good communication and maximum bandwidth. The 600-volt power supply has ample reserve to drive external accessories, if desired.

The unit measures 8" x 14" x 9". The company will supply further details and prices on either the kit or wired unit upon request.

SUBMINIATURE TANTALUMS

The Distributor Sales Division of Aerovox Corporation, New Bedford, Mass. is now offering a line of wire tantalum capacitors in subminiature

September, 1958

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sizes for applications in low-voltage devices such as personal portables, hearing aids, and transistorized circuits.

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The new capacitors are available from local distributors in standard voltage ratings of 1, 2, 4, 6, 8, 10, 20, 40, and 80 volts d.c.

NEW HAM RECEIVER

Hammarlund Manufacturing Company, Inc., 460 W. 34th Street, New York 1, N. Y. has recently added a triple-conversion, 17-tube superhet to its line of receivers for the radio amateur.

The Model HQ-170 offers full dial coverage of the 6, 10, 15, 20, 40, 80, and 160 meter amateur bands, separate vernier tuning (± 3 kc. for SSB operation), a separate linear detector for c.w. and SSB reception plus normal diode AM detection, seven selectivity positions for mechanical-filter-type skirt selectivity, selectable sideband, b.f.o. control (± 2 kc.), fast-attack a.v.c., and a built-in crystal calibrator.

In addition, the circuit includes a slot filter which is adjustable ± 5 kc. over the passband for better than 40 db attenuation. Additional attenuation of 20 db at any point is available with the slot-depth control. A dial-scale reset feature and automatic noise limiter are also included. The receiver is housed in a ventilated metal cabinet of modern design.

For a data sheet on this receiver and other details as required, write the manufacturer direct.

"15-IN-1" TRANSISTOR KIT

Students, experimenters, and hobbyists who are interested in learning how transistors can be used are being offered a "15-in-1" experimenters' kit by Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N. Y.

The new kit is designed to provide the maximum of instruction, entertain-

ment, and usefulness at minimum price. All components needed to build 15 different devices are included in the kit. A detailed instruction manual explains the operation of each circuit, shows how to mount the components, and how to make the necessary connections for building such devices as an electronic timer, a burglar alarm, two-stage audio amplifier, two-stage broadcast receiver, and many others. The kit is battery powered, shockproof, and entirely safe. It is catalogued as the KT-134.

"APACHE" TRANSMITTER KIT

Heath Company of Benton Harbor, Mich. is currently marketing a 180-watt amateur radio transmitter in kit form as the "Apache."

The transmitter operates with 150-watt phone input and 180-watt c.w. input. In addition to c.w. and phone operation, built-in switch-selected circuitry provides for SSB transmission through the use of a plug-in external adapter.

The circuit incorporates a compact and stable v.f.o. providing the low-drift frequency control necessary for SSB



transmissions. A slide-rule type illuminated dial with vernier tuning provides ample bandwidth and precise frequency settings.

The bandswitch allows quick selection of 80, 40, 20, 15, and 10-11 meter bands. This unit also has adjustable low-level speech clipping and a low-distortion modulator stage employing two EL34's in push-pull class AB operation. Time sequence keying is provided for chirpless break-in c.w. operation.

The final amplifier is completely shielded for greater TVI protection and transmitter stability.

A companion receiver, the "Mohawk," is available for use with this transmitter.

YOKE REPLACEMENT KIT

Triad Transformer Corporation, 4055 Redwood Ave., Venice, Calif. has introduced a new yoke replacement kit which makes it possible for the TV technician to service literally thousands of different TV chassis while maintaining a very small yoke inventory.

The "Yoke Pack" contains eight yokes and 25 network kits, offering almost unlimited network combinations. Housed in a display case, the kit offers both 70- and 90-degree type yokes, with inductance ranging from 8 to 30 mhy. for horizontal matching, plus a special unit for 70-degree drive applications.

RADIO & TV NEWS

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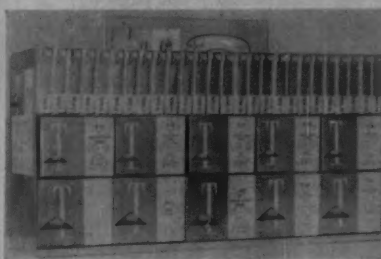
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(YC-1), both of which are included in the kit.

Additional information on this service item will be supplied by the company upon request.

IRE WRITING SYMPOSIUM

THE second annual Symposium of the IRE Professional Group on Engineering Writing and Speech is scheduled for October 1-2 at the Hotel Biltmore in New York City. Keynote speaker will be Dr. George H. Brown of RCA. Other speakers include Dr. Samuel J. Mason of MIT ("How to Murder an Audience") and Dr. James Angell of Philco ("Use of the Vu-Graph"). The two-day meeting will deal with common problems in oral and written communication, and will include sessions on speaking techniques, visual aids, and various aspects of writing. For information on program details, registration fees, etc. write to H. B. Michaelson, IBM Research Center, Box 218, Yorktown Heights, New York. —30—

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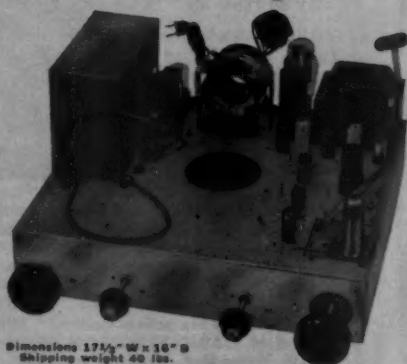


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1	5" PM SPEAKER 8 ohm 25 magnet	...\$1
20	- TUBULAR CONDENSERS .05-.600v	...\$1
20	- TUBULAR CONDENSERS .35-.600v	...\$1
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70	- ASSORTED 1 WATT RESISTORS	...\$1
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The "Electro-Melodeon"

(Continued from page 63)

you can't get something for nothing. Although it has the advantage of cheapness, resistive tuning cannot be used over a very wide tuning range. This is because too much resistance in series with C_1 will affect the generation of overtones and will impart an unpleasant quality to the note. For this reason, C_1 must have only a little more capacity than is required to produce the desired pitch. Then, just a few hundred ohms will be needed to accomplish the final precise tuning.

Work on the keyboard should not be started until the rest of the instrument has been completed. Then, connect together all of the A terminals of the 25 switches. A lead from one of the A terminals is then run to R_{10} . Next, wire up the B terminals. A connection is then made from the common B line to the junction of C_1 and R_{10} . Finally, wire all of the C terminals together. A wire goes from this common line to the junction of CH_1 and C_1 .

You can now begin to install the C_2 and C_3 capacitors. Start with the highest note, "A" (880 cps), and work down the scale. Either an audio oscillator or an accurately tuned musical instrument must be available for checking the frequency of each note as the capacitors are wired in place. The approximate value of C_2 required for each of the 25 notes is given in Table 1. Since the resonant frequency of the oscillator is dependent upon CH_1 and C_1 , as well as C_2 , manufacturing tolerances in these components may make it necessary to modify the values shown for C_2 to some extent. I suggest that you obtain a few extra .001 and .002 μ fd. capacitors. These can be used to parallel the C_2 capacitors, when necessary, so that resonance will be achieved when C_1 is set at mid-range.

As can be seen in Fig. 2, I used a number of ceramic capacitors in the keyboard circuit. This was only because I happened to have a large number of them in my junk box. If you go out and buy the keyboard capacitors new, I recommend that you get either mica or paper ones because of their accuracy and temperature stability. Unless designed specifically for frequency determining circuits, disc ceramic capacitors are apt to be lacking in both of these important characteristics.

Although any person who knows how to read music will experience little difficulty in learning to play the "Electro-Melodeon," the following hints may prove helpful. The melody is played with the right hand. This leaves the left hand free to operate the controls. Volume should be adjusted with the "Expression" knob, not the "Fundamental" or "Voice" knobs. These latter controls are used only for blending the sine- and overtone-outputs from the oscillator. The different tonal qualities resulting from changes in the position

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of the "Stop" switch will be most noticeable when the "Voice" control is fairly well advanced and the "Fundamental" control is near minimum. The "Vibrato" switch, normally left on, is turned off only for special effects. Do not depress more than one key at a time. If you do, you'll merely be throwing an extra capacitor across the oscillator tuning circuit. The result will be a note which is lower in pitch than that produced by either key alone.

If you, too, are fascinated by electronic musical instruments, but feel that a full-sized organ is beyond your capabilities, why not try your hand at constructing an "Electro-Melodeon"? I'm sure that you'll be both surprised and pleased when you discover how much pleasant music can come from this relatively simple, inexpensive instrument.

MICROPHONE TESTS AS THEY USED TO BE

By FRED LINGEL

"Joe took father's shoe bench out," sounds like a misplaced phrase but in the days not too long ago, it was part of a daily recital at some of our development laboratories.

Electronic equipment to mix audio frequencies properly and then inject them into a microphone was not readily available back in 1928. It was therefore common practice for a trained operator to repeat the two sentences "Joe took father's shoe bench out." She was waiting at my lawn into a microphone under test. First he called them into a standard microphone or transmitter and then into the microphone under test. A technician or technical assistant, as he was often called, would listen in another room. He would note the sound intensity from first one transmitter and then the other. Then he would call back to the operator to add or subtract attenuation from the circuit of the test transmitter. When he thought the two units sounded at about the same intensity, he would let the operator know and the amount of attenuation would be recorded for that particular transmitter.

The two sentences were chosen as those most suitable for duplicating the general range of frequencies used in voice telephone communication. In addition, the sentences contained frequency combinations such as those to give "s-es" which were found most important in understandable voice transmission. Trained technical assistants and good operators were often able to repeat test data to within 1/2 db.

Of course, back in the days of Joe and his father's shoe bench there were no decibels, as such. Instead it was a "T.U." or transmission unit. This was short for "the attenuation which would result from one mile of standard telephone cable." The present day decibel is 10 times the logarithm to the base 10 of the power ratio of the two transmitters. One T.U. produced roughly the same attenuation.

So for the record of how it was done not-too-long ago, we have for the hi-fi do-er of today the story of Joe and his waiting miss. And, too, there is a number D90733, the part number of one of the test transmitters. It means nothing today but it's strange the things one remembers as time rolls by.



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1C6	..35	6AN8	..89	6SJ7	..74	12SK7GT	..49
1C7G	..30	6AQ5A	..53	6SK7	..75	12SN7GT	..67
1D6	..28	6AS5	..60	6SN7GTB	..66	12SQ7	..67
1D7G	..30	6AT6	..53	6SQ7	..67	12V6GT	..58
1H5GT	..72	6AU4GTA	..85	6T4	1.12	12W6GT	..75
1L4	..45	6AU6	..52	6T8	..90	12X4	..45
1LC5	..49	6AV6	..44	6U8A	..85	14A7/12B7	..81
1LC6	..46	6AW5A	..86	6V6GT	..58	14A7	..88
1LW4	..60	6AX4GT	..86	6W4GT	..65	14B6	..78
1LN5	..48	6BA5	..80	6W6GT	..74	14Q7	..96
1N5GT	..48	6B7	..82	6X4	..46	17AX4GT	..72
1R5	..63	6B8A	..81	6X5	..58	19AU4GTA	..82
1S4	..77	6BC5	..87	6X8	..85	19	..25
1S5	..60	6BD6	..87	7AU7	..69	25AX4GT	..75
1T4	..60	6BE6	..85	7C4	..65	25BK5	..75
1U4	..60	6BF6	..49	8C67	..67	25BQ6A/	..99
1U5	..55	6BH6	..73	8CM7	..75	25C6	1.59
1V2	..55	6BK5	..82	12AD6	..59	25C6GB	..82
1X2B	..66	6BQ6A/6C6	..90	12AF6	..58	25L6GT	..73
2AF4	1.02	6BQ6GT	..90	12AL5	..53	25W4GT	..75
2AL5	..49	6BQ7A	..89	12AQ6	..81	25Z5	..75
2AUG	..58	6BU6	..70	12AT6	..74	25Z6GT	..75
2BN6	..75	6BZ2	..85	12AT7	..74	26	..71
2BU5	..71	6C4	..49	12AUG	..58	27	..25
2CB6	..58	6C5	..72	12AU7A	..81	28A5	..82
2CS6	..58	6C6	..89	12AV6	..46	28B5	..86
2DT6	..54	6CE6	..55	12AX4GTA	..72	28L6GT	..85
2V4	..59	6CD6GA	1.48	12AX7	..68	29W4	..39
4BC5	1.03	6CG7	..61	12B4A	..55	25/51	..25
4BN6	..78	6CG8A	..80	12BA6	..55	25V4	..66
4BQ7A	1.01	6CM7	..69	12BA7	..58	25Z3	..66
4BC5	..58	6CS6	..57	12BD6	..58	25Z6GT	..49
4BU5	..71	6CUG	..98	12BE6	..57	26	..25
4BZ7	1.03	6D6	..82	12BF6	..49	29/44	..25
4CB6	..58	6DB5	..69	12BH7A	..77	41	..77
5AM5	..79	6DD6GT	..67	12BK5A	..91	42	..75
5AN5	..80	6DQ6A	..99	12BL6	..58	43	..82
5AQ5	..54	6E5	..78	12BQ6GTB	1.19	45Z3	..30
5CG8	..81	6F6	..90	12BY7A	..69	50C5	..83
5J6	..71	6FG6GT	..71	12C5/12CUG	..58	50L6GT	..85
5U4GB	..85	6G6	..98	12CX6	..58	50X6	..80
5U5	..84	6H6	..70	12DK7	..81	50Y6GT	..79
5V3	..90	6J5	..65	12DQ6A	1.11	50Y7GT	..78
5Y3GT	..39	6K6	..75	12E6	..87	57	..46
5Y4GT	..84	6K7	..80	12F6	..75	78	..95
6A7	1.01	6K8	1.15	12K6GT	..89	80	..80
6A8	..98	6N7	1.15	12K7GT	..83	83	..85
6AB4	..57	6Q7	..88	12L6GT	..67	84/824	..64
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6AG5	..65	6SA7	..79	12SA7	..81	117H7GT	2.25
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Removing Resonances

(Continued from page 45)

12-position switch and a series of capacitors. The device covers a range of 300 to 3000 cps with the values shown. For frequencies above this range a standard, two-gang variable capacitor of the type used in broadcast receivers may be employed (with the sections paralleled) to tune continuously to the top of the audio range.

An inductance with good "Q" is important in achieving the narrow rejection slot needed to compensate for some resonances. A low-"Q" LC combination can be used to some advantage but will usually mean unnecessary attenuation of frequencies above and below the point of resonance. The 2.4-henry choke used in the circuit is rated at a minimum "Q" of 20 and, in order to obtain minimum insertion loss, a variable resistor is placed between the audio signal source and the LC elements to control the depth and width of the rejection slot. To some degree the effectiveness of this expedient is contingent upon the signal source being of relatively low impedance, such as the cathode-follower output found in most current preamplifier-control units. A high-impedance signal source will make it impossible to minimize the amount of rejection past a certain point. It should be noted, too, that apparently a number of preamplifier control units with cathode followers use a relatively small coupling capacitor to feed the outgoing line with the result that impedance at low frequencies may be on the order of 20,000 to 100,000 ohms. If the capacitor in the LC circuit is of nearly the same value or larger than the coupling capacitor, then serious low-frequency attenuation may result. In this case it may be desirable to parallel the control unit's output coupling capacitor with a 20- μ fd. electrolytic.

Once the series-resonant circuit has been "tuned" to the frequency where the greatest improvement in listening quality is noticed, it may be tucked out of sight where the settings of the two controls are not likely to be disturbed. It should be noted, however, that both the frequency and intensity of resonances in the system may vary over a

period of time, depending upon temperature, humidity, and other factors. This is one of the reasons why some outfits appear to change character over the months and years, hence retuning of the series-resonant circuit may be desirable after a period of time has elapsed.

Several precautions are in order when locating the series-resonant unit. The most important of these is to keep it away from power transformers, motors, and other magnetic devices whose fields may cause inductive hum pickup. A second, and somewhat contrary, recommendation is to keep the length of shielded cable between the unit and power amplifier relatively short in order to minimize the effects of cable capacitance on high-frequency response. Usually the choke in the series-resonant circuit can be oriented for minimum pickup from a particular hum source and, as the audio level will probably be a fraction of a volt, there should be no problem in most installations.

When dealing with resonant frequencies below 300 cps, it is desirable to use a larger value of inductance in order to insure a favorable LC ratio. Power supply chokes are readily available in values from 8 to 30 henrys and are relatively inexpensive. Care should be taken in selection, however, as reasonably good "Q" and freedom from distributed capacity that might cause an unwanted peak in the mid-frequency range are requisite. Fig. 3 gives the component values for a circuit employing a 15-henry choke and tuning from 30 to 300 cps. With this circuit, it is possible to compensate for the primary resonances of speakers and phonograph pickup arms as well as possible enclosure or room resonances falling within this range.

Fig. 5 shows some of the circuits that may be used to achieve rejection of a particular frequency range. Fig. 5A is identical to those already described and requires a relatively low-impedance audio source for the widest range of operation. The circuit of Fig. 5B may be used with a medium-to-high-impedance signal source, as can the circuit of Fig. 5C which is similar. However, for moderate amounts of attenuation, these two circuits act like band-rejection filters, due to their phase characteristics, and are less use-

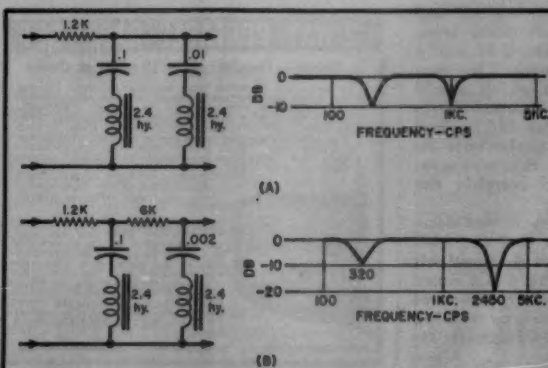


Fig. 7. (A) Two series resonant circuits in parallel. Rejection at 1000 cps may be lower than at 320 cps due to lower "Q" of second element. Increasing resistance widens two slots until they merge. (B) Inclusion of second resistor allows higher rejection from second circuit element, which may be tuned either above or below first.

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ful in suppressing a single resonance in the system. The circuit of Fig. 5D although again looking much like the preceding configurations, provides a slot of constant width and varying depth and should be driven by a low-to-medium-impedance signal source. Fig. 5E is a circuit in which the tube plate resistance is used as the element determining the amount of rejection obtained. Fig. 5F is a parallel-resonant circuit which can be placed in the cathode circuit to obtain rejection by means of degenerative feedback.

Thus far we have proceeded on the assumption that there will be only one major undesirable resonance in the system, although of course this may be far from the actual case. Fig. 4 indicates five of the most common resonant peaks that may be encountered in a system. It may be desirable to compensate for two or more of these. Fortunately, this is quite easy to do by cascading or paralleling series-resonant elements, as shown in Fig. 7. Preferably the operating frequencies of the two circuits should be fairly well separated and the one which requires the higher amount of rejection should be inserted the farthest from the signal source.

The use of series-resonant compensation provides a convenient and versatile method of reducing the unwanted effects of resonance in a hi-fi system and, in the author's experience, can produce an astonishing improvement in clarity and naturalness, particularly in the case of mid-range defects. In addition, these circuits may be used to some advantage in recording work to improve instrumental balance or to reduce the harshness or nasal quality of a voice. They can also be used to achieve a wide variety of tonal coloration in such recording applications.

No doubt a great many other uses for the resonant circuits described in this article will suggest themselves to the audio experimenter who wants to try some novel effects.

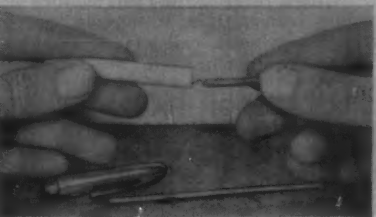
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By PETER BARNA

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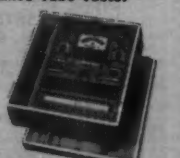


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thoroughly familiar with Author Hartley's style and his unique faculty for "stirring up the Indians." An individualist of the first water and a respected British audio engineer, Mr. Hartley has covered audio techniques—from amplifiers to transformers, feedback, tone controls, speakers, and enclosures—in his own inimitable fashion.

Written at a not-too-technical level, with a minimum of mathematics and engineering concepts—this volume would be entirely suited for both the professional sound man and the enlightened audiophile.

The text itself is divided into twelve chapters covering the perception of sound, the audio output stage, inverters and drivers in audio amplifiers, voltage amplification, amplifier design, audio transformers, negative feedback, filters and tone controls, amplifier power supplies, speakers and enclosures, measurements and testing—winding up with a humdinger concluding chapter, written in first person singular, entitled "High Fidelity—hail and farewell."

The same spritely approach which characterized the author's series of articles in this magazine, "Realistic High Fidelity," is carried over into this book.

We believe that most persons interested in the electronic reproduction of sound will find this volume both challenging and instructive.

The lucky winners of Thorens' unique "10 Year" hi-fi contest receive their awards from Paul W. Kind (center), head of the firm. Hi-fi salesman James Carroll (left) of Harvey Radio Co., New York receives a check for being the "favorite audio salesman" of the winner, Hannes Beckmann (right) of New York. As the author of the best 50-word description of his "favorite hi-fi dealer's salesman," Mr. Beckmann will receive his choice of any one Thorens hi-fi product each year for ten years. For his first choice, he selected the firm's new TD-124 turntable. The winners were selected by the editors of six leading publications in the hi-fi field: W. A. Stocklin, Editor, RADIO & TV NEWS; Warren DeMotte, Associate Editor, HI-FI & MUSIC REVIEW; John M. Conly, Editor, High Fidelity; Milton B. Sleeper, Publisher, HI-FI Music at Home; M. Harvey Gernsback, Editorial Director, Radio-Electronics; and Anthony Lord, Managing Editor, High Fidelity Trade News.



September, 1958

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TEST REPORT Hi-Fi Components

NEW SHURE "DYNETIC" CARTRIDGE



THERE are always surprises from Shure Brothers. It wasn't too long ago that they announced the development of their "Studio Dynetic" cartridge and tone arm assembly. It was a big surprise then in that this cartridge was an electromagnetic transducer where formerly Shure Brothers were primarily known in the field of crystal and ceramic cartridges. They now have a relatively new addition to their line—the "Professional Dynetic" series which like its predecessor is an electromagnetic transducer using a moving magnet. It differs in that this unit needs no special tone arm. It can be used with almost any arm found on record changers and with transcription turntables. Its recommended load impedance is 27,000 ohms and it has an output voltage of .021 volt which is suitable for driving almost any high-fidelity system

having a magnetic input without the use of a special transformer. Tests made in our own laboratory showed an extremely smooth response from 30 to 17,000 cps and then dropping off rather rapidly. For those who are interested in an extended high-frequency response, the load resistance may be increased.

The stylus assembly is held in place by a plastic composition which provides extremely high needle compliance, resulting in practically no "needle-talk."

Listening tests made in comparison with other cartridges showed that this new Shure unit is a top contender in the present cartridge field. It is extremely smooth yet brilliant and the over-all effect is one of ease. The published tracking force requirement of three to six grams certainly was confirmed in that we had no tracking problems, even on some of the loudest passages. This led us to believe that even lower tracking pressures could have been used.

Another important feature is that stylus replacement is especially simple and fast and no tools are required. It is not a turnover cartridge as many are today. It is available in only two models—the M5D for microgroove records with a 1 mil diamond stylus and the M6S for standard 78 rpm records with a 2.7 mil sapphire stylus.

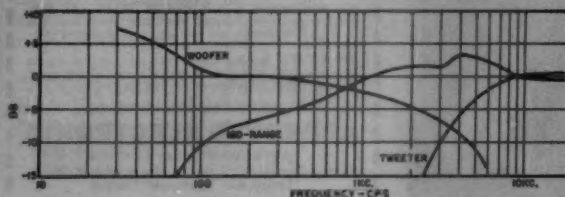
—SM—

"SHIELDCREST" SPEAKER SYSTEM

WE have seen and tested many speakers from such countries as England, Japan, and Germany but only recently have we run across such units imported from Denmark. The one we have just tried is a three-way system consisting of a 12-inch woofer, 5-inch mid-range, 2-inch tweeter, and an LC crossover network. All of the speakers are cone-type units and are being marketed under the tradename of "Shieldcrest" for \$24.88 (including crossover network) by Olson Radio Warehouse of Akron, Ohio.

These units are certainly worthy of comment, not only because they are extremely low priced but also because

we encountered some unusual results. Our first approach was to analyze the dividing network and the results are shown in the diagram below. It was interesting to note that there are actually three crossover points; one at about 750 cps, one at 3500 cps, and one at 9000 cps. The woofer and mid-range curves roll off at only about 3 db per octave. This may be compared with the usual 6 db per octave, or even 12 db per octave, that is more widely used. Further analysis showed that the entire network is basically a two-way system with the mid-range speaker operating throughout the entire mid- and high-frequency range.



Response characteristics of the dividing network showing the crossover points.

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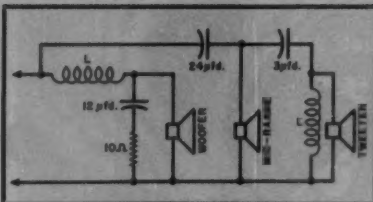
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Wiring diagram of the crossover network.

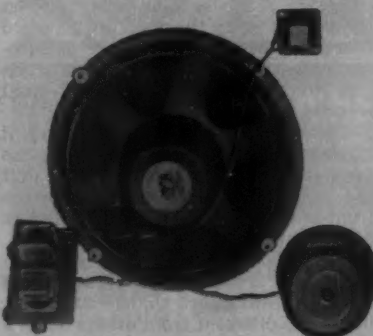
This is rather unusual but not necessarily detrimental to the over-all performance of the system. We know of another system which sells in the \$500.00 range that was designed in similar fashion.

Normal practice is to cut off the speakers very sharply at the crossover points to confine each speaker to its particular portion in the audio spectrum. The greatest advantage of this principle is to reduce intermodulation distortion.

The individual speakers, particularly the woofer, were extremely good performers. Cone resonance of the woofer was found to be quite low—on the order of 34 cps. We ran across one point at which the woofer did break up audibly but with further re-checking we were unable to repeat the break-up condition.

Listening tests showed up quite well.

The three speakers with the LC network.



Under normal room listening conditions, with an infinite baffle, the speaker system had a pleasant quality. It was somewhat heavy at the bass end but some high-fidelity enthusiasts may prefer this.

We do not wish to imply that this system can compare with any of the much higher priced, top-quality systems on the market today in "cleanliness" of response and freedom from intermodulation distortion, but in view of its modest price, we cannot deny that it is a good system.

GARRARD AUTOMATIC RECORD CHANGER

THE Garrard RC121/II record changer is one of the most recent additions to British Industries Corporation's line of hi-fi components. This unit warrants special mention in that it incorporates

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27-39 mc. Equipped with 10 push buttons for selecting channels. Cont. variable tuning over the entire range. Unit complete with tubes, built-in loud speaker, squelch circuit, head phone jacks, schematic diagram on bottom of case. Approx. weight 34 lbs.
Used, good... **\$12.50** each
12- or 24-volt D.C. Dynamotor... each **\$3.95**

BC603 FM RECEIVER

Same description as BC683 except that range is 20-27 mc. This unit complete with tubes.
Like New... each **\$6.95**
Manual with schematic for BC603 & BC604... **\$1.00** each

BC684 TRANSMITTER

(Used with BC683 receiver.) Used, good... **\$4.95** each
CRYSTALS (set of 80) for BC604 transmitter... **\$5.00**

BC659 FM TRANSCEIVER

29-40 mc, 2 channels, crystal control. Unit complete with tubes, built-in speaker and dual meter for testing. Approx. dimensions 16" x 13" x 7 1/4".
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Manual with schematic for BC659... each **\$1.00**

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TEST SCOPE—SYNCHROSCOPE— PULSE ANALYZER

ID-59/AF-11. Late production. Modular subassembly construction. Video amplifier is flat to 4 mc. 3BP1 presentation. Test-scope sawtooth 25-20,000 cy. Has all normal test-scope controls. As synchroscope and pulse analyzer, accepts positive or negative pulses. Video delay circuit permits leading edge of pulse to be seen. Calibrated-dial horizontal shift measures pulse durations from 0.5 to 100 microseconds. Sawtooth-calibrator measures recurrence rates from 200 to 6000 pps accurate within 0.4%. Built-in power supply requires 115v, 400 cy, 196 watts. External 60 cy power supply may be made to furnish plus 350 and -1300 vdc and 6.3 vac. In excellent condition, with all 19 tubes, schematic with parts values, parts-location pictures, operating instructions, theory explanation, and maintenance charts. Shipping weight 60 lbs. Used, good. Price each **\$16.95**

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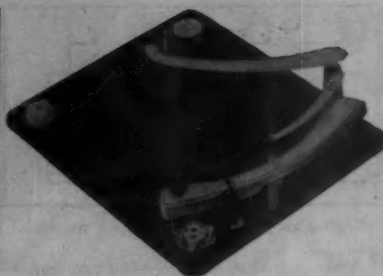
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The Garrard RC121/II Record Changer

all of the desired quality and ease of operation that one would look for in a moderately priced record changer.

It will handle all four speeds: 16%, 33%, 45, and 78 rpm. It will automatically play any number of records up to ten, in 7", 8", 9", 10", or 12" diameters. All 10- and 12-inch records of the same speed can be intermixed in any desired order without affecting the automatic operation of the changer. All other size records may be played automatically at the same time provided the smaller diameter records are placed above the larger ones.

In addition to the automatic mixing facilities, records may also be played manually and the changer stopped and started as desired without rejecting the record being played.

The manual operation is a "must" feature, in our opinion, for any record changer. Although the basic idea on the part of an owner is to use a record changer to play a stack of records automatically, there are many times when one would like to play individual records.

The manual control is not unusual since most record changers provide the same facility, but in this particular unit the ease with which one can switch from automatic to manual operation is quite gratifying.

The use of the center post for stacking records is the simplest arrangement for automatic record changers and this unit is no different from others using a similar mechanical system in that there is bound to be eventual wear on the center hole of the record.

Extensive listening tests were made using several different test records and we were pleasantly surprised to find very little wow, flutter, or rumble even under exaggerated conditions. It was unusually free from such unwanted effects considering that this changer is in the medium-priced field and therefore should not be expected to match the quality of any of the really top-notch professional units that are available on the hi-fi market today.

—50—

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Manufacturers' Literature

INDUSTRY "FACT BOOK"

Electronic Industries Association, 1721 DeSales Street, N.W., Washington 6, D. C. has announced publication of its 4th annual "Fact Book" for 1958.

The value of consumer products, tubes, semiconductors, components, and military and industrial equipment is included in this new reference book along with details on the production and sales of various industry items.

Non-members and the general public can obtain copies of the book by writing the Washington headquarters and enclosing 50 cents per copy.

TRANSISTOR CATALOGUE

Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N. Y. has just issued a four-page, two-color catalogue sheet listing the complete line of Texas Instruments semiconductor devices which it is prepared to supply from stock.

Among the units listed are silicon transistors, silicon diodes and rectifiers, as well as germanium transistors. Complete electrical specifications are given on each type handled.

Copies of this brochure are available without charge from the distributor.

DYNAMOTOR CATALOGUE

Carter Motor Company, 2793A W. George St., Chicago 18, Ill. is now offering copies of its new 28-page dynamotor catalogue to interested persons.

The catalogue lists the company's new fan-cooled "Genemotor" as well as several new models comprising the "Genemotor" line which has been materially improved in appearance, performance, and service accessibility. In addition, eleven new listings appear in the 1½" and 2" frame "Genemotors," increasing their range of application.

Catalogue No. 158 is available from the manufacturer without charge.

EICO'S NEW CATALOGUE

Electronic Instrument Co., Inc. 33-00 Northern Blvd., Long Island City 1, N. Y. is now offering copies of its 16-page, 2-color catalogue describing the complete EICO line of electronic test instruments and high-fidelity equipment available in both kit and wired form.

The test instruments covered include v.t.v.m.'s, v.o.m.'s, oscilloscopes, tube and transistor testers, signal and sweep generators, battery eliminators, substitution boxes, flyback testers, battery testers, RCL bridges, electronic switches, voltage calibrators, Geiger counters, and accessory probes. The audio line includes an FM tuner,

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DATA ON "FRAMELOK GRID"

A new booklet which describes the design and performance advantages of its "Framelok Grid" construction for electron tubes has been issued by Sylvania Electric Products Inc., 1100 Main St., Buffalo, N. Y.

This 12-page brochure lists structural features of the new grid design and points up their effect on other tube elements. Ratings and performance characteristics of the firm's first "Framelok" tube, a 6FH6 horizontal deflection type, are included in the brochure.

MAINTENANCE HINTS

National Electronics, Incorporated, Geneva, Ill. has issued a pocket-sized, 20-page booklet entitled "Maintenance Hints."

Designed to be of help to equipment engineers and users who work with equipment incorporating electronic tubes, the publication gives maintenance hints for equipment using ignitrons, thyratrons, and gas-filled rectifiers. In each instance both causes of troubles and symptoms are discussed in non-technical terminology with a final section of the booklet devoted to approved practices for handling electron tubes.

The company will supply copies of this handbook without charge as an industry service.

"BUSINESS BUILDERS"

CBS-Hytron's Advertising Service, Parker Street, Newburyport, Mass. has just issued a completely revised fourth edition of its "Business Builders Catalogue" of sales promotion materials, technical literature, and service tools for independent service technicians.

The 16-page catalogue describes and illustrates over 90 useful items ranging from printed-circuit soldering aids to illuminated outdoor signs. A new easy-to-read format makes it possible to find needed items quickly.

When writing for a copy of this publication, please specify form PA-37. It will be supplied complete with order blank and price list.

EIA STANDARDS LIST

Electronic Industries Association, Room 650, 11 West 42nd St., New York 36, N. Y. has issued a 12-page booklet which lists recommended standards, specifications, and engineering publications which are currently available.

The list includes bulletins and publications of general interest, television and facsimile test charts, specifications for military components, standards, plus an alphabetical listing of the standards.

For a free copy of this index plus details on how individual standards can be ordered, write to the Engineer-

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UTC TRANSFORMERS

United Transformer Corporation, 150 Varick St., New York 13, N. Y. has just issued its 25th anniversary catalogue covering electric wave filters, high "Q" coils, transformers, reactors, and magnetic amplifiers.

This 34-page publication provides complete specifications on a wide variety of components and, in addition, carries schematics for five amplifiers ranging in power from 20 watts to 60 watts. A reactance-frequency chart has been included for the convenience of amplifier designer-builders. The company's line includes a number of transformers designed especially for transistor circuits.

B&K TEST INSTRUMENTS

B&K Manufacturing Co., 3726 N. Southport Ave., Chicago 13, Ill. has just issued a colorful 4-page booklet which covers the firm's tube checkers, "Television Analyst," and test instruments for in-the-home servicing and shop use.

Performance and other pertinent data is provided on each instrument, along with a photograph and price information. Copies of Bulletin No. AP12 are available without charge.

AUTO RADIO CAPACITORS

Sprague Products Company, North Adams, Mass. is currently offering a new manual which gives a complete list of "Atom" and "Twist-lok" electrolytic replacement capacitors for use in auto radios manufactured from 1946 through 1957. Some forty makes of radios are listed alphabetically with the company's replacements cross-referenced to the original part numbers.

Copies of the manual are available from the firm's distributors without charge or from the company at 51 Marshall St. for 10 cents.

NEW MILLER CATALOGUES

J. W. Miller Company, 5917 S. Main Street, Los Angeles 3, Calif., has announced publication of two new catalogues of interest to the electronic industry.

No. 159 is a new edition of the "TV Technician's Coil Replacement Guide" which lists the company's replacements for parts which appeared in the color and black-and-white sets of some 67 manufacturers. Both original part numbers and Miller replacements are listed in tabular form.

The second publication, No. 59, is a general catalogue covering the firm's complete line of industrial electronic, radio, and TV r.f. coils; chokes, line filters, coil kits, i.f. transformers, and special i.f. windings.

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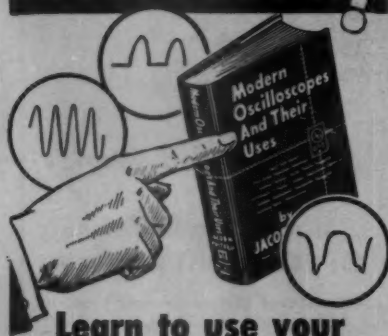
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Within the Industry (Continued from page 28)

Institute of Radio Engineers and the Acoustical Society of America. He has been a director of EIA since 1956.

A. W. ORLACCHIO has been appointed chief engineer of the Glennite Instrumentation Division, Gulton Industries, Inc.

Mr. Orlacchio joined the firm in 1952 and was placed in charge of the development of electromechanical instruments. His new duties as chief engineer include all design, development, and production engineering for products of the Division.

Previously employed at the National Bureau of Standards in Washington, D. C., he worked in the field of propagation of sound through solid media.

Mr. Orlacchio is a member of the Acoustical Society of America, the Institute of Environmental Engineers, and the Instrument Society of America.



JERROLD ELECTRONICS CORPORATION has moved to new and larger quarters at Jerrold Building, 15th Street & Lehigh Avenue, Philadelphia 32, Pennsylvania... SUPERSCOPE INC. has moved its executive offices to 8520 Tujunga Avenue, Sun Valley, California... AMPHENOL ELECTRONICS CORPORATION has announced the formation of a new western division to be located in Chatsworth, California. A 20,000 square foot plant has been erected to house the division, which will have its own complement of sales, engineering, manufacturing, and financial personnel. General manager will be James H. Schaefer... PACKARD BELL COMPUTER CORPORATION has announced the relocation of its offices to 1905 Armacost Avenue, Los Angeles 25, Calif... JENSEN INDUSTRIES, Forest Park, Illinois, announces plans for a plant expansion to increase its floor space by 50 per-cent. The firm will thus increase its factory to 60,000 square feet... TELONIC INDUSTRIES, INC. plans to move its engineering division, TELONIC ENGINEERING CORP., to Laguna Beach, California where it will expand its development and engineering facilities... H. H. SCOTT, INC. is now settled in its new building at 111 Powder Mill Road, Maynard, Mass.

ELECTRONIC INDUSTRIES ASSOCIATION has appointed the following as members of a newly established engineering department policy committee: Ben Adler, president of Adler Communications and chairman of the EIA technical products division; Robert S. Bell, president of Packard Bell Electronics Corp. and chairman of consumer products division; Sidney R. Curtis, senior vice-president, of Stromberg-Carlson Co. and chairman of military products

GREAT!

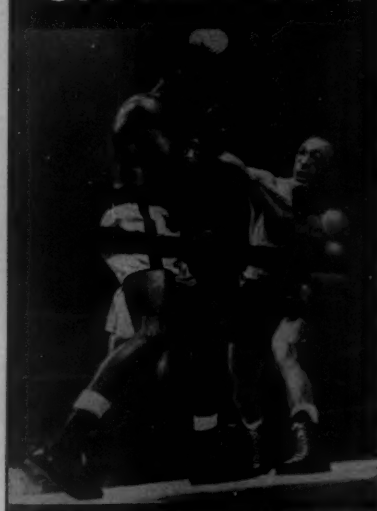


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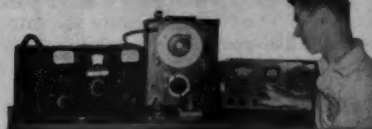
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September, 1958

division; D. W. Gunn, vice-president, sales, of *Sylvania Electric Products Inc.* and chairman of the EIA tube and semiconductor division; and W. S. Parsons, president of *Centralab*, division of *Globe Union, Inc.* and chairman of the EIA parts division.

The principal function of the committee will be to provide closer liaison between the Association's engineering department's various committees and management.

ELECTRONIC INSTRUMENT CO., INC. (EICO) has expanded its design laboratories and production lines to a newly modernized, one-level 45,000 square foot area at 33-00 Northern Blvd., Long Island City 1, N. Y. . . Construction is now under way on an ultra-modern, one-story plant for the manufacture of special-purpose vacuum tubes by the components division of **INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION**. The 58,000 square-foot building, rising on an 18-acre site, is located in Roanoke, Virginia . . . The computer division of **BENDIX AVIATION CORP.** has established a computing center at 205 East 42nd Street, New York, N. Y. . .

ANDERSON CONTROLS, INC. has relocated its general offices at 9959 Pacific Avenue, Franklin Park, Illinois . . .

THE NARDA ULTRASONICS CORPORATION has acquired a one-story building at 625 Main Street, Westbury, Long Island, N. Y. The new facility will provide the company with 16,500 square feet of additional production space . . .

PIONEER ELECTRONICS CORPORATION has taken over an additional building adjoining its plant at 2235 South Carmelina Avenue, West Los Angeles, California. The modern, one-story brick building will provide an additional 10,000 sq. ft. for warehouse, administration, and testing facilities . . .

INSTRUMENTS FOR INDUSTRY, INC. has completed plans for a new building to be located on New South Road, Hicksville, New York . . . **MERIT COIL & TRANSFORMER CORPORATION** is establishing a Canadian warehouse at 700 Weston Road, Toronto . . .

Negotiations will be completed shortly for the construction of a new 150,000 square foot electronics laboratory building on Route 128 in Burlington, Mass. for the microwave and power tube division of **RAYTHEON MANUFACTURING COMPANY**. Estimated completion date is early 1959 . . .

U. S. ELECTRONICS DEVELOPMENT CORP. has announced the moving of its entire administrative and manufacturing facility from Glendale, Calif. to Phoenix, Arizona.

ROBERT R. SHERWOOD has been appointed executive vice-president of *Rek-O-Kut Company, Inc.* . . . *Sylvania Home Electronics*, a division of *Sylvania Electric Products Inc.*, has announced the following promotions: **RICHARD J. STAFFORD**, marketing administrator; **CHARLES L. HUBBARD**, product planning manager; and **JOHN E. LAU**, sales manager, radio and high-fidelity . . . **E. C. RAYMUND** has been promoted to the post of executive vice-

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- **New! Mobile Western Electric Single Hand Set and Microphone** (The one the long distance operators use). This latest model tiny microphone is attached to single earphone which allows complete freedom (no hands). Comes complete with leather headband. A gem of a buy at \$5.95 ea. 2 for \$10.00.
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- **Cornell-Dubilier Heavy-Duty 12 Volt Power Supply.** C.D. Model No. 3414 Heavy-Duty 200 Volts D.C. Output at 335 MA. Vibrator Supply Units are made with the finest of components and best construction for long trouble-free use. All units are brand new, packed in original cartons. Units come complete with two CK-106 Rectifier Tubes and C.D. Vibrator Type 12VP10. Input: 12.6 VDC's. Output: 200 Volts D.C. at 335 Milliamperes. Size: 8-1/4" High x 13-1/4" Wide x 7-1/2" Deep. Weight: 28 lbs. Sale Price \$19.50
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president in charge of marketing for both U. S. Electronics Development Corporation and U. S. Semiconductor Products, Inc. . . . **KARL O. BATHKE** has been named assistant to the president, Capitol Radio Engineering Institute, with over-all responsibility for sales, advertising, promotion, and public relations . . . **Philco Corporation** has made known the following new appointments in its consumer products division: **HAROLD W. SCHAEFER**, vice-president, product development and planning for appliances; and **ARMIN E. ALLEN**, vice-president, product development and planning for electronics . . . **SAM KAPLAN**, vice-president and treasurer of Zenith Radio Corporation, has been elected a member of the corporation's board of directors . . . **ROLAND V. (DICK) PAYNE** has been appointed merchandising and field sales manager of the Hallmark Division, Paramount Enterprises, Inc. . . . **J. REID ANDERSON** has joined Stanford Research Institute as manager of the computer laboratory . . . **STANLEY S. SIEVERS** has been named sales manager of Kin Tel Division of Cohu Electronics, Inc. . . . **Central Electronic Manufacturers, Inc.** announces the appointment of **GENE G. PERRY** as general sales manager . . . **JOSEPH C. WORTH, JR.** is now sales manager of U. S. Electronics Development Corp. . . . **LEROY D. KILEY**, general manager of the Friez Instrument Div. of Bendix Aviation Corporation, is retiring after 17 years of service with the firm.

ELECTRONIC INDUSTRIES ASSOCIATION is asking members to expand the Association's statistical services to include the collection, on a monthly basis, of factory production of FM receivers.

This is being done due to manufacturers' realization that in addition to the 540 commercial FM stations and 145 non-commercial FM outlets now on the air there are 72 construction permits outstanding as contrasted with 23 one year ago. It is felt that accurate statistics on production of this segment of the consumer products industry are important to its continued growth.

The Association has also announced

that a new record was established by electronics manufacturers during the fiscal year 1957-58, reaching an estimated \$7.5 billion level compared with \$5.7 billion recorded during the previous year. When distribution, service, installation, and broadcast revenue is added, the total billing of the electronics industry is about \$12.5 billion, considerably over the \$11 billion recorded for the industry during 1956-57.

FRANK W. WALKER has been named a vice-president and manager, government sales, by Motorola Communications & Electronics, Inc., a wholly owned subsidiary of Motorola Inc.



He has been with the firm for ten years, the last five as regional manager in the southwestern United States. Prior to that he has served in sales management positions in New York and Michigan.

In his new position Mr. Walker will assume over-all responsibility for sale, contact, lease, and service relationships with Federal agencies.

TWIN CITY ELECTRONIC WHOLESALE ASSOCIATION has been incorporated in Minneapolis, Minn. Its function will be to guide the general electronic activity in the area such as promoting good will to dealers, engineers, consumers, and students, and also to offer factory education programs to the trade.

The Association will perform independently of any national organization. The directives will be issued by officers and/or directors. Meetings will be held as often as necessary but not less than once monthly. The local address is 1200 Nicollet Avenue.

ELECTRONIC INDUSTRIES ASSOCIATION re-appointed Kenneth H. Brown of Westinghouse Electric Corp. as chairman of its service committee, 1958-59. W. D. Renner, Howard W. Sams & Co., Inc. has been re-named as the vice-chairman.

-30-

Texas Instruments Incorporated has opened its new \$5,000,000 Semiconductor Components Division plant at 6000 Lemmon Ave., Dallas, Texas with an elaborate dedication ceremony attended by industry leaders and government officials. The building was designed and constructed to solve the problem of providing a suitable environment for the manufacture of semiconductor devices while offering a comfortable and pleasant place in which to work. Of rectangular shape, the building is of unitized construction. It is built on the side of a hill so that entrances to both floors are at ground level. In the center of the building are two glass-enclosed garden courts, open to the sky, which afford a sight of out-of-doors to personnel in all areas. Other patios are located right outside the building. The exterior facing of the second floor is marble. The plant is air- and humidity-conditioned.



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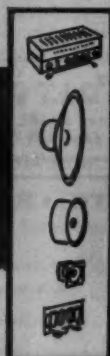
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BUILD Full Strength Meter, diagram, instructions \$1.00. Rule, 360 Glendale, Lexington, Ky.

ASSORTED Condensers, Leads Cut Short \$3.00 per hundred. M. B. Green, Louin, Miss.

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8AU6	.89	6U6	.89	35Z6	.89	666A	1.80
8A4	.79	6W6	.89	50A5	.61	666A	1.80
8BA6	.89	6W6	.89	50B5	.89	5875	1.20
8B7	1.00	6X5	.89	50L6	.89	6550	2.90
8B6	.89	6Y6	.89	50L6	.89	6550	2.90
8B6	.89	7N7	.89	KT66	3.29	5642	11.00
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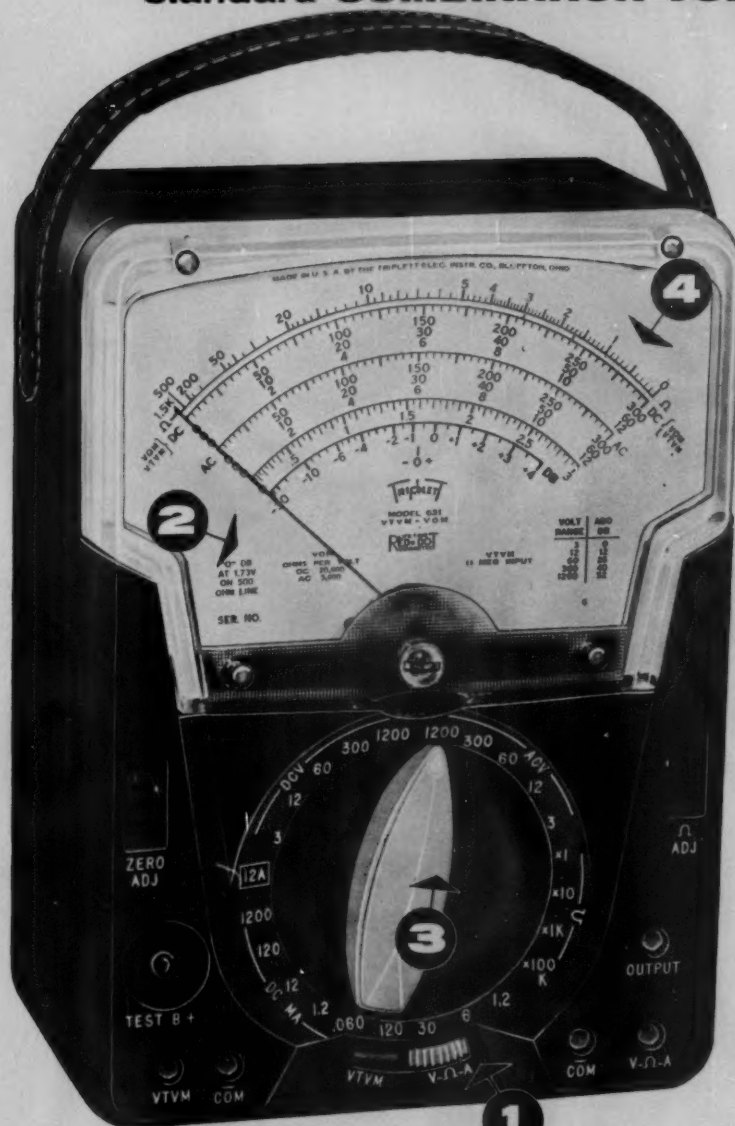


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8450MA 91¢ @ .5 for 52; 8500MA 91¢ @ .5 for 52; 8550MA 91¢ @ .5 for 52; 8600MA 91¢ @ .5 for 52; 8650MA 91¢ @ .5 for 52; 8700MA 91¢ @ .5 for 52; 8750MA 91¢ @ .5 for 52; 8800MA 91¢ @ .5 for 52; 8850MA 91¢ @ .5 for 52; 8900MA 91¢ @ .5 for 52; 8950MA 91¢ @ .5 for 52; 9000MA 91¢ @ .5 for 52; 9050MA 91¢ @ .5 for 52; 9100MA 91¢ @ .5 for 52; 9150MA 91¢ @ .5 for 52; 9200MA 91¢ @ .5 for 52; 9250MA 91¢ @ .5 for 52; 9300MA 91¢ @ .5 for 52; 9350MA 91¢ @ .5 for 52; 9400MA 91¢ @ .5 for 52; 9450MA 91¢ @ .5 for 52; 9500MA 91¢ @ .5 for 52; 9550MA 91¢ @ .5 for 52; 9600MA 91¢ @ .5 for 52; 9650MA 91¢ @ .5 for 52; 9700MA 91¢ @ .5 for 52; 9750MA 91¢ @ .5 for 52; 9800MA 91¢ @ .5 for 52; 9850MA 91¢ @ .5 for 52; 9900MA 91¢ @ .5 for 52; 9950MA 91¢ @ .5 for 52; 10000MA 91¢ @ .5 for 52; 10050MA 91¢ @ .5 for 52; 10100MA 91¢ @ .5 for 52; 10150MA 91¢ @ .5 for 52; 10200MA 91¢ @ .5 for 52; 10250MA 91¢ @ .5 for 52; 10300MA 91¢ @ .5 for 52; 10350MA 91¢ @ .5 for 52; 10400MA 91¢ @ .5 for 52; 10450MA 91¢ @ .5 for 52; 10500MA 91¢ @ .5 for 52; 10550MA 91¢ @ .5 for 52; 10600MA 91¢ @ .5 for 52; 10650MA 91¢ @ .5 for 52; 10700MA 91¢ @ .5 for 52; 10750MA 91¢ @ .5 for 52; 10800MA 91¢ @ .5 for 52; 10850MA 91¢ @ .5 for 52; 10900MA 91¢ @ .5 for 52; 10950MA 91¢ @ .5 for 52; 11000MA 91¢ @ .5 for 52; 11050MA 91¢ @ .5 for 52; 11100MA 91¢ @ .5 for 52; 11150MA 91¢ @ .5 for 52; 11200MA 91¢ @ .5 for 52; 11250MA 91¢ @ .5 for 52; 11300MA 91¢ @ .5 for 52; 11350MA 91¢ @ .5 for 52; 11400MA 91¢ @ .5 for 52; 11450MA 91¢ @ .5 for 52; 11500MA 91¢ @ .5 for 52; 11550MA 91¢ @ .5 for 52; 11600MA 91¢ @ .5 for 52; 11650MA 91¢ @ .5 for 52; 11700MA 91¢ @ .5 for 52; 11750MA 91¢ @ .5 for 52; 11800MA 91¢ @ .5 for 52; 11850MA 91¢ @ .5 for 52; 11900MA 91¢ @ .5 for 52; 11950MA 91¢ @ .5 for 52; 12000MA 91¢ @ .5 for 52; 12050MA 91¢ @ .5 for 52; 12100MA 91¢ @ .5 for 52; 12150MA 91¢ @ .5 for 52; 12200MA 91¢ @ .5 for 52; 12250MA 91¢ @ .5 for 52; 12300MA 91¢ @ .5 for 52; 12350MA 91¢ @ .5 for 52; 12400MA 91¢ @ .5 for 52; 12450MA 91¢ @ .5 for 52; 12500MA 91¢ @ .5 for 52; 12550MA 91¢ @ .5 for 52; 12600MA 91¢ @ .5 for 52; 12650MA 91¢ @ .5 for 52; 12700MA 91¢ @ .5 for 52; 12750MA 91¢ @ .5 for 52; 12800MA 91¢ @ .5 for 52; 12850MA 91¢ @ .5 for 52; 12900MA 91¢ @ .5 for 52; 12950MA 91¢ @ .5 for 52; 13000MA 91¢ @ .5 for 52; 13050MA 91¢ @ .5 for 52; 13100MA 91¢ @ .5 for 52; 13150MA 91¢ @ .5 for 52; 13200MA 91¢ @ .5 for 52; 13250MA 91¢ @ .5 for 52; 13300MA 91¢ @ .5 for 52; 13350MA 91¢ @ .5 for 52; 13400MA 91¢ @ .5 for 52; 13450MA 91¢ @ .5 for 52; 13500MA 91¢ @ .5 for 52; 13550MA 91¢ @ .5 for 52; 13600MA 91¢ @ .5 for 52; 13650MA 91¢ @ .5 for 52; 13700MA 91¢ @ .5 for 52; 13750MA 91¢ @ .5 for 52; 13800MA 91¢ @ .5 for 52; 13850MA 91¢ @ .5 for 52; 13900MA 91¢ @ .5 for 52; 13950MA 91¢ @ .5 for 52; 14000MA 91¢ @ .5 for 52; 14050MA 91¢ @ .5 for 52; 14100MA 91¢ @ .5 for 52; 14150MA 91¢ @ .5 for 52; 14200MA 91¢ @ .5 for 52; 14250MA 91¢ @ .5 for 52; 14300MA 91¢ @ .5 for 52; 14350MA 91¢ @ .5 for 52; 14400MA 91¢ @ .5 for 52; 14450MA 91¢ @ .5 for 52; 14500MA 91¢ @ .5 for 52; 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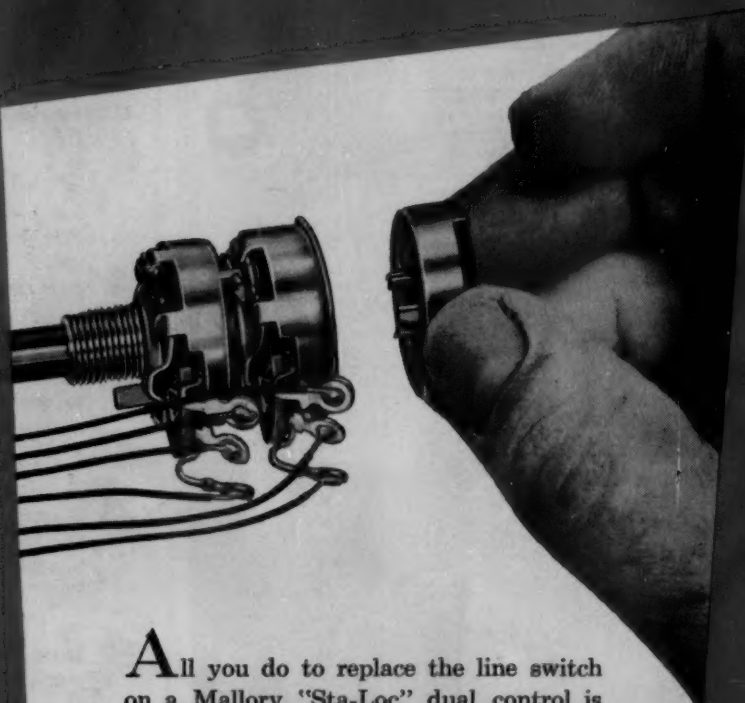
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